

NISSAT

Department of Scientific & Industrial Research

**DIRECTORY OF  
ON-GOING PROJECTS IN  
FOOD SCIENCE AND  
TECHNOLOGY AND  
RELATED AREAS IN INDIA**



National Information Centre for Food Science and Technology  
CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE  
MYSORE 570 013, INDIA

1986







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AND TECHNOLOGY AND RELATED AREAS  
IN INDIA**







N I S S A T  
Department of Science and Technology

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AND TECHNOLOGY AND RELATED AREAS  
IN INDIA

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Revised Edition

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National Information Centre for Food Science and Technology  
CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE  
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## INTRODUCTION

### COVERAGE

The directory, which is an updated version of the one published in 1979, covers on-going projects in food science and technology and related areas in India that were current between 1979 and 1985.. The information on projects were collected by way of a questionnaire distributed to over 500 institutions out of which about 250 responded. Out of over 1600 project/programmes, thus received, 1191 projects/programmes from 140 institutions have been selected for inclusion in this Directory as they are considered to have some relation or other with post-harvest technology. The main objective is to collect information in the area and help in coordination of interest in the Food Science and Related Areas.

### OBSERVATIONS ON PROJECTS

Most institutions did not follow the proforma while supplying information on projects and in many cases information was incomplete. This made the compiler's job quite difficult. This also indicated that there was lack of uniform procedure in the formulation of projects. Many institutions did not appear to cost the projects individually and also tended to split up a project into fragments each one of which designated as an independent project. Thus the numerical parameter does not indicate the involvement of real magnitude of a particular institution in the area. Therefore, the extent, content, depth and published records as background materials for each current programme/project would give the measure of actual contributions in the post-harvest technology of the Discipline of Food Science. Therefore, this compilation suffers from its inherent inadequacies.

CFTRI, by virtue of its following defined procedure in formulation and implementation of the projects and its higher financial and manpower inputs compared to other institutions except Government departments, stands out as a significant institution specialising in food science and technology. The projects of Government departments mostly concerned on production, distribution and evaluation of foods like balahar, balamul, miltone, etc. developed by CFTRI. The agricultural universities and ICAR institutions, though accounting for larger number of projects, contribute mostly to areas peripheral to food science and technology. In the case of ICAR, nearly 80% of the projects are by NDRI on dairy products. Among the other institutions contributing to this directory the Government sponsored research institutes include BARC which conducts work on food irradiation and the others either contributing to interface areas or concerned with



regulatory analytical and quality control aspects. The University departments and industries have relatively small number of projects though with considerable budget. The contributions of ICMR are mostly by NIN, Hyderabad, in the field of nutrition and toxicology.

#### ORGANISATION

The entries in the Directory have been sequenced under broad subject headings with subheadings wherever necessary. To facilitate easy retrieval of information, three indexes have been provided, namely, subject index, institution index and investigator index.

#### ENTRY FORMAT

Each entry contains the following information: Serial Number, Project Title, Name and Address of the organisation; Project Category; Cost; Duration; Sponsor(s); Investigator(s); Description; Report(s) and Papers published.

Cross references between related projects within the Directory is indicated by a '\*\*' followed by the serial number(s) of the project(s). References to related entries in the Directory published in 1979 is indicated by '\*●', again followed by the serial number(s) of the project(s).

#### ACKNOWLEDGEMENT

Acknowledgements are due to scientists and organisations who have cooperated in the compilation of this Directory by providing the needed information by returning the filled-in-questionnaires.

Acknowledgements are also due to Sri G. Rajendran of NICFOS for his help in composing the matter for printing and to Shri Umesh and his colleagues, in the CFTRI offset printing press for having printed the directory in short time.

#### SUGGESTIONS

Any comments and suggestions regarding this directory are welcome and may be communicated to Area Coordinator, FOSTIS, CFTRI, Mysore 570 013.

#### UPDATING

This directory is intended to be updated periodically. Information on programmes/projects not included in this directory as well as new projects may kindly be sent to FOSTIS as per the entry format used in the directory.



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# ENGINEERING AND EQUIPMENT

## Storage System

- 1 Project Title : Storage, drying, grading and handling of farm products.  
Organisation : Punjab Agricultural University, Ludhiana 141 004; College of Agricultural Engineering, Department of Processing and Agricultural Structures.  
Project Category : Applied.  
Cost : Rs.1,32,000/- per annum.  
Duration : 1969-  
Sponsor(s) : Punjab Government.  
Investigator(s) : Kashyap, M.M. and others.  
Description : The project aims to develop suitable technique, and equipments for storage, handling, drying and refrigeration of farm products.  
Report(s) : Nil  
Papers published : \*\*229
- 2 Project Title : Low temperature storage of perishable products.  
Organisation : Punjab Agricultural University, Ludhiana-141 004; College of Agricultural Engineering; Department of Processing and Agricultural Structures.  
Project Category : Applied.  
Cost : Rs. 97,950/- per annum.  
Duration : 1974-  
Sponsor(s) : Punjab Government.  
Investigator(s) : Kashyap, M.M.; Gupta, A.K.  
Description : The identification of engineering problems in cold storage; the efficiency of cheap insulation material like paddy husk etc.; development of better temperature and humidity system design and control; development and better use of structural materials and standardization of cold storage design and development of refrigerated transport vehicles are being investigated.  
Report(s) : Nil  
Papers Published : \*\*229
- 3 Project Title : Design and development of vapour absorption refrigeration system utilising solar energy/waste heat for cold storage application.  
Organisation : Central Mechanical Engineering Research Institute, Durgapur-713 209  
Project Category : Applied and Developmental.  
Cost : -  
Duration : -  
Sponsor(s) : CSIR  
Investigator(s) : -  
Description : An open-cycle solar refrigeration system using water as refrigerant and lithium chloride brine as absorbent is under design and development. It has 1-ton refrigeration capacity. Dilute lithium chloride brine from the absorber gets concentrated in a solar regenerator where water-vapour is transferred to the ambient air. An improved design of the solar generator to suit the climate of Durgapur has been considered. This still-type regenerator will; make the system independent of water vapour pressure in the ambient air and reduce the contamination of the brine. The system is capable of producing chilled water at a temperature around 15 C lower than the cooling water temperature with an overall CoP of 0.25. Electrical power consumption would be 0.45 kw as compared to 0.75 kw for a conventional vapour compression refrigeration system of the same capacity.

Project Title	: Large scale application, monitoring and evaluation of improved technologies for food loss prevention and reduction of pollution in rural and plantation rectorors.
Organisation	: Central Food Technological Research Institute, Mysore-570 013; Infestation Control and Pesticides.
Project Category	: Applied.
Cost	: Rs. 5,44,145/-.
Duration	: June 1982-May 1984.
Sponsor(s)	: CSIR
Investigator(s)	: Sharangapani, M.V. and others.
Description	: The project envisages evaluation of acrylonitrile as rat burrow disinfectant in farmer's fields; installation of modula and pre-fabricated structures in rural storage complexes; scaling up of dehydrobin and drying crib under conditions of farm houses; application of physical storage methods in rural houses; installation of decontamination systems for water and soil in farms and farm houses; and monitoring and development of rural disinfection operators and their organizations for viable transfer of food storage and rural disinfection technologies.
Report(s)	: -
Papers Published	: -

  

Project Title	: Cereal and oil mill sanitation, processed product disinfection and related storage systems.
Organisation	: Central Food Technological Research Institute, Mysore-570 013; Infestation Control and Pesticides.
Project Category	: Applied.
Cost	: Rs. 5,96,274/-.
Duration	: April 1982-March 1984.
Sponsor(s)	: CSIR
Investigator(s)	: Muthu, M. and others.
Description	: The project intends to develop appropriate storage technologies and mill sanitation techniques in relation to various types of mills used with a variety of products like rice, oilseeds, etc. It involves identifying the origin, bionomics, assessment of losses in quality in cereal and oilseed processing plants. Entomological and mycological problems, rodent infestation and sanitation aspects will also be investigated.
Report(s)	: -
Papers Published	: -

  

Project Title	: Godown construction project in 3 districts.
Organisation	: Co-operative for American Relief Everywhere Inc. (CARE), Khairatabad, Hyderabad-500 004.
Project Category	: Applied.
Cost	: Rs. 5,81,000/-.
Duration	: 1981-1982.
Sponsor(s)	: CARE - 45%; Panchayat Raj Department - 55%.
Investigator(s)	: Monroe and others.
Description	: For safe and scientific storage of CARE food commodities at district level go-downs are being constructed in 3 districts of Andhra Pradesh.
Report(s)	: -
Papers Published	: -

  

Project Title	: (i) Design, development and testing of modern grain storage structures for their use in the rural and urban areas. (ii) Improvement of traditional grain storage structures and evaluation. (iii) Design, development and testing of grain dryers for their use at farmers' land.
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- Organisation : Indian Grain Storage Institute, Hapur-245 101.  
 Project Category : Applied.  
 Cost :  
 Duration : 1977-1979.  
 Sponsor(s) : Government of India, Ministry of Agriculture and Irrigation, Department of Food, New Delhi.  
 Investigator(s) : Birewar, B.R. and others.  
 Description : Various types of indigenous raw materials were used to build rural storage structures which represented improvements over traditional ones. Simple grain dryers using energy like solar energy, coal, timber and paddy husk were developed and tried.  
 Report(s) : -  
 Papers Published : -
- 8 Project Title : Evaluation of the efficiency of different kinds of grain storage structures with reference to insect damage.  
 Organisation : Orissa University of Agriculture and Technology; College of Agriculture, Bhubaneswar-751 003; Entomology Department.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1975-1980.  
 Sponsor(s) : University.  
 Investigator(s) : Rout, G.; Jacob, T.J.  
 \*12
- 9 Project Title : Analysis, design and construction of farm buildings.  
 Organisation : Central Building Research Institute, Roorkee, Uttar Pradesh.  
 Project Category : Applied.  
 Cost : -  
 Duration : April 1977-March 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Mehrotra, S.N.; Batra, Y.K.  
 Description : Low cost grain silos for rural areas using locally available materials were designed. Extensive trials were conducted to try out their efficacy.  
 Report(s) : -  
 Papers Published : -  
 \*13
- 10 Project Title : Application, modification and development of storage bins utilising the local material and skill.  
 Organisation : Punjabrao Krishi Vidyapeeth, Akola-444 104; Harvest and Post Harvest Technology Scheme.  
 Project Category : Applied.  
 Cost : Rs. 7,35,000/-.  
 Duration : June 1975-March 1979.  
 Sponsor(s) : International Development Research Centre, Canada; and Indian Council of Agricultural Research, New Delhi.  
 Description : -  
 Investigator(s) : Hiwase, S.S. and others.  
 Report(s) : -  
 Papers Published : -  
 \*14
- 11 Project Title : Further improvement of P.K.V. bin and Pusa bin.  
 Organisation : Punjabrao Krishi Vidyapeeth; Akola-444 104; Harvest and Post Harvest Scheme.  
 Project Category : Applied.  
 Cost : Rs. 95,812/-.  
 Duration : September 1972-March 1979.

- |                  |   |   |
|------------------|---|---|
| Sponsor(s)       | : | Indian Council of Agricultural Research, New Delhi. |
| Investigator(s)  | : | Mazumdar, G.K. and others.                          |
| Description      | : | -   |
| Report(s)        | : | -   |
| Papers Published | : | -   |
- 
- |    |                  |   |  |
|----|------------------|---|--|
| 12 | Project Title    | : | Driage losses in stored food grains in godowns.  |
|    | Organisation     | : | Indian Grain Storage Research Institute, P.B.No.10, Hapur-245101.  |
|    | Project Category | : | Applied.   |
|    | Cost             | : | -  |
|    | Duration         | : | 1981-1983.   |
|    | Sponsor(s)       | : | Government of India, Ministry of Agriculture, Department of Food.  |
|    | Investigator(s)  | : | Varma, B.K. and others.  |
|    | Description      | : | The project aims to estimate driage losses in wheat, paddy and rice stored in Food Corporation of India. |
|    | Report(s)        | : | -  |
|    | Papers Published | : | -  |
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- |    |                  |   |  |
|----|------------------|---|--|
| 13 | Project Title    | : | Design, development and testing of farm level and community type modern grain storage structures.  |
|    | Organisation     | : | Indian Grain Storage Institute, P.O.Box No.10, Hapur-245 101.  |
|    | Project Category | : | Applied.   |
|    | Cost             | : | -  |
|    | Duration         | : | 1980-1982.   |
|    | Sponsor(s)       | : | Government of India, Ministry of Agriculture, Department of Food.  |
|    | Investigator(s)  | : | Birewar, B.R. and others.  |
|    | Description      | : | The structures for cleaning, drying, storage and processing of food grains particularly at the farm level were developed and improved. For this, different types of locally available raw materials like steel, aluminium welded wiremesh, cement concrete, bricks rubberised cloth, timber, paddy straw etc. were used for development of the structures. Simple designs of farm level crop dryers using solar energy and agricultural waste material like fire-wood, coal, paddy husk, peanut shell, dry plants, etc. and hand operated grain cleaning device have been developed. |
|    | Report(s)        | : | -  |
|    | Papers Published | : | -  |
- 
- |    |                  |   |  |
|----|------------------|---|--|
| 14 | Project Title    | : | Operational research trials on coal tar drum bins.   |
|    | Organisation     | : | Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal-462 010.  |
|    | Project Category | : | Applied and survey.  |
|    | Cost             | : | -  |
|    | Duration         | : | 1978-  |
|    | Sponsor(s)       | : | ICAR   |
|    | Investigator(s)  | : | Agrawal, A.K.  |
|    | Description      | : | Locally manufactured coal tar drum bins were tested in 3 villages for storage of either wheat or Bengal gram. The initial and final quality of the grain was monitored and followed up in the end of the trial with the farmers using the bins being interviewed for recording their observations according to a specially designed score chart. It was found that rate of adaptability according to the score chart was about 85%. Most farmers found the bins more suitable for domestic needs than for marketable surpluses of wheat with them. |
|    | Report(s)        | : | -  |
|    | Papers Published | : | -  |



- 15 Project Title : Evaluation of improved structures for storage of Bengal gram.  
 Organisation : Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal-462 010.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1978-  
 Sponsor(s) : ICAR  
 Investigator(s) : Alam and others.  
 Description : Improved structures like coal tar drum bin, Hapur bin and polyethylene sandwiched mud bins were compared with mud bin and gunny bags for storage of Bengal gram. The grain stored better in coal tar drum bin and Hapur bin. In mud bin, the storage losses were high due to initial infestation. Gunny bags were inferior as in them the insect damage rapidly increased after the monsoon season. Polyethylene sandwiching, as in mud bins, did not provide the needed tightness. It was also noted that if Bengal gram is initially infested, further infestation cannot be avoided without prophylactic measures even in improved structures.  
 Report(s) : -  
 Papers Published : -
- 16 Project Title : Storage of rapeseed and Bengal gram.  
 Organisation : Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal-462 010.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1978-  
 Sponsor(s) : ICAR  
 Investigator(s) : Alam, A. and others.  
 Description : Rapeseed and Bengal gram were stored in pervious (gunny bags) semi-pervious (mud-bins) and impervious (metallic containers) structures at 7, 9, 12, 13 and 15% moisture contents (wet basis). Grain temperature, moisture content, insect infestation was recorded periodically. Data showed that for safe storage, Bengal gram and rapeseed should be stored at 11.0 and 9.0% moisture respectively. In mud bins, Bengal gram suffers more damage than even in gunny bags. Even in metallic containers prophylactic measures were desirable to store pulses. With rapeseed, insect infestation was not a problem and thus its storage in gunny bags is desirable from the point of view of economics.  
 Report(s) : -  
 Papers Published : 1.Gupta, O.P. and others. A note on calcium oxide as grain protectant. (Sci. Cult. 46; 1980; 30-1).  
 2.Raich, K.V. and others. Studies on storage of pulses. (Paper presented at 16th annual convention of Indian Society of Agricultural Engineering, IIT, Karagpur, December, 1978).
- 17 Project Title : Testing and evaluation of different storage bins for their relative performance.  
 Organisation : University of Agricultural Sciences, Hebbal, Bangalore; Harvest and Post-Harvest Technology Scheme.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1975-1977.  
 Sponsor(s) : ICAR  
 Investigator(s) : Krishnamurthy, K.C. and others.  
 Description : The performance of different types of storage structures for storage of sorghum and groundnut under different conditions are evaluated. In the local gumme, plywood and tar drums, hybrid grain sorghum may be safely stored, with prior fumigation and polythene



lining inside gumme for about one year. However, with more initial cost the plywood and tar drum bins can be used safely. The physical condition of the groundnut kernels stored in plywood and metal bins was quite unsatisfactory when compared to plastic, earthen pot, gunny and polyethene bags, which showed no deterioration in the quality of the kernels even after 4 months storage.

Report(s) : AICRP, Annual Report - 1977.  
Papers Published : -

- 18 Project Title : Study of storage parameters of onion and development of a low cost onion storage structure.  
Organisation : University of Agricultural Sciences, Hebbal, Bangalore-560 024; Harvest and Post Harvest Technology Scheme.  
Project Category : Applied.  
Cost : -  
Duration : 1979-1982.  
Sponsor(s) : ICAR  
Investigator(s) : Vijayakumar Lugalgi, F. and others.  
Description : The project envisages to investigate the losses during onion storage connected with the weather changes and hence attempts to find out a good and cheaper storage structure. The onion bulbs were stored in 3 designs of split bamboo structures along with gunny bag as control. All the structures were kept in-door. It was deduced that temperature of 30-31 C and RH of 50-60% is better suited for storing onions. The split bamboo structure with central hollow was found better among all the structures.  
Report(s) : AICORP Annual Report (Post-harvest Technology).  
Papers Published : -
- 19 Project Title : Standardisation of the equipment, food and kitchen area of industrial canteens.  
Organisation : Food Craft Institute, Engineering College Hostel Campus, Shivajinagar, Pune-411 005.  
Project Category : Applied and Survey.  
Cost : Rs. 5,000/-.  
Duration : August 1978-August 1979.  
Sponsor(s) : Institute; and Industrial canteens.  
Investigator(s) : Gangolli, V.A. and others.  
\*18
- 20 Project Title : Development of food processing equipment for (1) aroma recovery, effect evaporator (4) cocoa butter extraction, (5) continuous blanching of peanuts, (6) vacuum destoner/classifier and (7) mini-flour mill.  
Organisation : Central Food Technological Research Institute, Mysore-5/0013; Process Development.  
Project Category : Applied.  
Cost : Rs. 8,53,000/-.  
Duration : June 1982-May 1984.  
Sponsor(s) : Institute.  
Investigator(s) : Ramesh, A. and others.  
Description : Aroma recovery unit of capacity 1,000 kg juice per hour is set up and all design drawings for 2000 kg/hr unit are made. Peel oil extractor work is being taken up on receipt of "Cipro Press" being imported. Double effect evaporator drawings is under progress. Design and fabrication 200 kg/hr water capacity evaporator fabrication is completed. Mini flour mill using hammer mill is being set up.  
Report(s) : -  
Papers Published : -

- 21 Project Title : Design and development of solar water heater.  
 Organisation : Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal-462010.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1978-  
 Sponsor(s) : ICAR  
 Investigator(s) : Prasad, S.  
 Description : A solar water heater of 200 litre capacity was designed and fabricated out of discarded oil barrel with saw dust as thermal insulator. The solar collector was kept facing south and included at an angle of 35° with the horizontal plane. It was found that the heater, which works on thermosiphon principle, gave hot water at 55-59 C and 45-50 C respectively during winter evening and morning. The cost of the solar water heater was calculated to be about Rs. 1,400.00.  
 Report(s) : -  
 Papers Published : -
- 22 Project Title : Processed foods plant at Hyderabad.  
 Organisation : Government of India; Ministry of Agriculture, and Irrigation, Krishibhavan, New Delhi 110 001; Department of Food; Food and Nutrition Board.  
 Project Category : Applied.  
 Cost : Rs. 1,00,00,000/-.  
 Duration : 1977-  
 Sponsor(s) : Food and Nutrition Board; UNICEF; and Government of Andhra Pradesh.  
 Investigator(s) : Shah, V.H. (Kaira District Milk Producers Union Ltd., Anand).  
 \*19
- 23 Project Title : Design and development of time and labour saving devices for groundnut processing.  
 Organisation : University of Agricultural Sciences; Agricultural Engineering Institute, Raichur-584 101.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977-  
 Sponsor(s) : University.  
 Investigator(s) : Krishnamurthy, K.C. and others.  
 Description : -  
 Report(s) : -  
 Papers Published : -
- 24 Project Title : Development and testing of groundnut pod separator.  
 Organisation : University of Agricultural Sciences; Agricultural Engineering Institute, Raichur; Department of Farm Machinery.  
 Project Category : Applied.  
 Cost : Rs. 5,000/-.  
 Duration : 1977/78-1980/81  
 Sponsor : University.  
 Investigator(s) : Naravani, N.B.; Guruswamy, T.  
 Description : Earlier, a pedal operated device had been developed at the college of Agriculture, Dharwad. Now, a power operated machine has been designed, fabricated and tested. The same will be released for general use. A portable pedal operated device has also been fabricated and the same will be tested during the year.  
 Report(s) : -  
 Papers Published : 1. Guruswamy, J. and Naravani, N.B. Effect of types of drums on the performance efficiency of groundnut pod stripper. (Agric. Agro. Indus. J. 1980).

2. Guruswamy, J. and Naravani, N.B. Groundnut pod separator - a time and labour saving device. Paper presented at the XVII Annual Convention Indian Society for Agricultural Engineer held at New Delhi, 1980.
3. Naravani, N.B. and Guruswamy, J. Groundnut pod plucking machine - a time and labour saving device. Paper presented at the Seminar on oilseeds crops held at UAS, Raichur Campus, 15 May 1979.

- 25
- Project Title : Field evaluation of groundnut grader and decorticator developed at Coimbatore.
- Organisation : Central Institute of Agricultural Engineering, Nali Bagh, Berasia Road, Bhopal - 460 010.
- Project Category : Applied.
- Cost : -
- Duration : 1978
- Sponsor(s) : ICAR
- Investigator(s) : Bisht, B.S.; Agrawal, A.K.
- Description : Manual grading and decortication which is mainly by village women is a costly operation on the assumption that use of mechanical decorticator could give better profits of farmers. Studies on the evaluation of functional performances of the grader/decorticator developed by Tamil Nadu Agricultural University were initiated.
- Report(s) : -
- Papers Published : -
- 26
- Project Title : Development of equipment for improving processing of cashewnut.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Plantation Products and Flavour Technology.
- Project Category : Developmental.
- Cost : Rs. 1,31,200/-.
- Duration : January 1977-January 1979.
- Sponsor(s) : Institute.
- Investigator(s) : Ramesh, A. and others.
- Description : A cashew kernel dryer was designed as part of the project. It is an electric dryer of 500 kg/batch having the following components: a) Drying cabinet b) Air heater and c) Centrifugal fan.
- Report(s) : Final.
- Papers Published : -
- \*25
- 27
- Project Title : Development of a cashew shelling machine.
- Organisation : Central Mechanical Engineering Institute, MERADO, Cochin.
- Project Category : Applied and developmental.
- Cost : -
- Duration : -
- Sponsor(s) : CSIR
- Investigator(s) : -
- Description : This will be a compact semi-automatic machine. It will consist of a pair of splitter blades to cut the outer shell and a mechanism to simultaneously separate the kernel from the shell by a lifting knob.
- Report(s) : Annual.
- Papers Published : -



- 28 Project Title : Design and development of improved devices for dehusking coconut and arecanut.  
 Organisation : Central Plantation Crops Research Institute, Kudla, Kasargod-670124.  
 Project Category : Applied.  
 Cost : Rs. 1,32,400/-.  
 Duration : October 1977-October 1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Bangali Baboo and others.  
 \*28
- 29 Project Title : Development of improved methods and equipment for processing of walnut.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Process Development and Design Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,19,100/-.  
 Duration : April 1977 - March 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Ramesh, A. and others.  
 Description : A sieve for separation of hulls and a machine for washing of walnut were fabricated. For loosening of hull walnuts were stacked in wooden trays for a specific period and trays were placed to have suitable clearance between the ground and trays for aeration. This method prevented rotting of walnut hull as also hardening. A centrifugal huller with a modified bottom having parallel metal strips instead of 2.5 cm weld mesh enabled better separation of hull and nut, reduced the hold-up of material in the machine and increased the percentage of hulling. A washing machine with a wooden drum lined with coir brush on the interior was tried. This unit which handled 10 kg of nut per change was worked by rotating by hand and gave satisfactory results. The unit have since been offered for use by small-scale processors.  
 Report(s) : Final.  
 Papers Published: : 1. Prabhakar, J.V. and others. Improving the quality of walnuts grown in Kashmir valley by better post-harvest processing methods. (Presented at Symposia on Production and Utilisation of Forest Products, RRL, Jammu-Tawi, March 1979).  
 \*368
- 30 Project Title : Design and development of a grading machine for pepper.  
 Organisation : Central Mechanical Engineering Research Institute, MERADO, Cochin.  
 Project Category : Applied and developmental.  
 Cost : -  
 Duration : -  
 Sponsor(s) : CSIR  
 Investigator(s) : -  
 Description : The machine will be suitable for grading of pepper according to Agmark specifications. It consists of a revolving perforated drum within which a rotary screw conveys the pepper to be graded across its length. The machine will be fabricated as soon as the testing of the scaled down model is over.  
 Report(s) : Annual.  
 Papers Published : -
- 31 Project Title : Development of less expensive cleaners for cereals, pulses and oilseeds.  
 Organisation : University of Agricultural Sciences; Agricultural Engineering Institute, Raichur-584 101.  
 Project Category : Applied.

- Cost : -  
Duration : 1978-1980.  
Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
Investigator(s) : Krishnamurthy, K.C. and others.  
\*27
- 32 Project Title : Fabrication of palmirah neera evaporator.  
Organisation : Central Mechanical Engineering Research Institute, MERADO, Madras.  
Project Category : Applied and developmental.  
Cost : -  
Duration : -  
Sponsor(s) : CSIR  
Investigator(s) : -  
Description : The evaporator is of the forced circulation type in which neera can be reduced to syrup for ultimate use for production of beverages and sugar.  
Report(s) : Annual.  
Papers Published : -
- 33 Project Title : Design and development of a sheller for sunflower seeds.  
Organisation : Tamil Nadu Agricultural University; College of Agricultural Engineering, Coimbatore-641003; Agricultural Processing Department.  
Project Category : Applied.  
Cost : -  
Duration : 1978-  
Sponsor(s) : University.  
Investigator(s) : Shanmugham, C.R.  
\*33
- 34 Project Title : Development of new types of heating systems for drying farm produce.  
Organisation : Central Food Technological Research Institute, Mysore-570013; Process Development and Design Discipline.  
Project Category : Applied.  
Cost : Rs. 1,39,600/-.  
Duration : June 1978 - May 1980  
Sponsor(s) : CSIR  
Investigator(s) : Chandra, P.K. and others.  
Description : Husk fired furnaces and solar energy collectors were designed and tested. A natural convection drier was designed, fabricated installed and tested. The problem of slow heating-up of air was overcome by suitable modifications. A recirculatory drier for drying 500 kg of paddy per hour was also designed and fabricated.  
Report(s) : Final.  
Papers Published : -  
\*42
- 35 Project Title : Biogas and solar energy design.  
Organisation : National Dairy Development Board, Anand-388001.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Board.  
Investigator(s) : -  
Description : Efforts were intensified on development of equipment driven by alternative sources of energy, especially biogas and solar energy. A techno-economic feasibility study of steam boilers supported



by solar water heaters for use extensively in chilling centres, was conducted, R&D work was continued to design an improved solar water heater. Another equipment designed was a 14 hp engine (consuming 80% biogas and 20% diesel) This is now being used at Bidaj Sabarmati Ashram, Gaushala, to operate a chaff cutter.

Report(s) : -  
Papers Published : -

- 36 Project Title : Design, development and evaluation of farm level and commercial grain dryers and drying systems.  
Organisation : Indian Institute of Technology, Kharagpur-721 302; Post-harvest Technology Centre.  
Project Category : Fundamental, Applied and Survey.  
Cost : Rs. 1,14,000/-.  
Duration : May 1980 - May 1982  
Sponsor(s) : ICAR  
Investigator(s) : Ojha, T.P. and others.  
Description : A farm level drying system utilising solar energy and agricultural waste was developed earlier. Currently, a new drying system using only solar energy (flat plate and storage) has been developed and performance studies on it are under way.  
Report(s) : -  
Papers Published : 1. Ojha, T.P. and others. Solar storage grain drying system with planar reflectors - Paper accepted for presentation at the International Conference to be held at Asian Institute of Technology, Bangkok.
- 37 Project Title : Development and testing of recirculatory batch dryer using farm wastes as fuel.  
Organisation : University of Agricultural Sciences; G.K.V.K. Campus, Bangalore-560065; Agricultural Engineering Department.  
Project Category : Applied.  
Cost : Rs.1,60,000/-.  
Duration : 1978-  
Sponsor(s) : University.  
Investigator(s) : Javare Gowda, S.  
\*50
- 38 Project Title : Design and fabrication of suitable dryers.  
Organisation : Central Plantation Crops Research Institute, Kudlu, Kasargod-670124.  
Project Category : Applied.  
Cost : Rs.2,00,000/-.  
Duration : October 1977-October 1982.  
Sponsor(s) : Institute.  
Investigator(s) : Jaswant Singh and others.  
\*51
- 39 Project Title : Development of an improved centrifugal sheller for the mini rice mill.  
Organisation : Central Food Technological Research Institute, Mysore-570013, Process Development and Design Discipline.  
Project Category : Applied.  
Cost : Rs. 86,500/-.  
Duration : June 1978 - Dec.1979  
Sponsor(s) : CSIR  
Investigator(s) : Chandra, P.K.; Murthy, H.K.

- Description : An improved horizontal centrifugal sheller was designed and detailed drawings prepared.
- Report(s) : Final.
- Papers Published : -
- \*53
- 40 Project Title : Development of a portable tray type drier using agricultural waste as fuel.
- Organisation : University of Agricultural Sciences, Hebbal, Bangalore.
- Project Category : Applied.
- Cost : Rs. 1,600/-.
- Duration : May 1976-January 1977.
- Sponsor(s) : Indian Council of Agricultural Research.
- Investigator(s) : Krishna Murthy, K.C. and others.
- Description : The drier has been fabricated with brick wall lining, hard blower, chimney and lid. CSH.5 sorghum grain was dried to bring-down moisture percentage from 21% to 9.2% at fuel consumption of 4 kg jungle wood for 2 quintals of grains. The equipment has been found suitable for small and marginal farmers because it requires only 3 hours for drying the grain with the help of this drier.
- Report(s) : AICROP on Post-Harvest technology quinquennial report
- Papers Published : -
- \*54
- 41 Project Title : Evaluation of heated air drier for drying of sorghum.
- Organisation : University of Agricultural Sciences; Agricultural Engineering Institute; Raichur-584 101.
- Project Category : Applied.
- Cost : -
- Duration : 1976-1979.
- Sponsor(s) : ICAR, New Delhi.
- Investigator(s) : Krishnamurthy, K.C. and others.
- \*58
- 42 Project Title : Evaluation of heated air drier for drying of groundnut.
- Organisation : University of Agricultural Sciences, Hebbal, Bangalore-560024; Harvest and Post harvest scheme.
- Project Category : Applied.
- Cost : -
- Duration : June 1980 - Dec.1980.
- Sponsor(s) : Indian Council of Agricultural Research.
- Investigator(s) : Krishna Murthy, K.C. and others.
- Description : The project supports the mechanical drying of groundnut which takes 10 hours to reduce moisture from 18.96% to 10.92% as compared to the natural drying which takes 14 hours to remove the same percentage of moisture from wet pods.
- Report(s) : AICRP on Post Harvest Technology Annual Report (1980) pp.38-44.
- Papers Published : -
- \*55
- 43 Project Title : Design and development of cocoa dryer suitable for growers.
- Organisation : Central Plantation Crops Research Institute, Kudlu, Kasargod-670124.
- Project Category : Applied.
- Cost : -
- Duration : 1977-1979.
- Sponsor(s) : Institute.
- Investigator(s) : Bangali Baboo and others.
- \*60



- 44 Project Title : Development of a solar drier for drying of foods.  
 Organisation : Jadhavpur University, Calcutta-700 032; Food Technology and Biochemical Engineering Department.  
 Project Category : Applied.  
 Cost : Rs. 10,000/-.  
 Duration : 1978-1979.  
 Sponsor(s) : UNICEF.  
 Investigator(s) : Mukherjee, S.  
 \*65
- 45 Project Title : Development and testing of small size and large size solar agricultural dryer.  
 Organisation : Central Arid Zone Research Institute, Jodhpur-342003; Division of Wind Power and Solar Energy Utilisation Studies.  
 Project Category : Applied and developmental.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Garg, H.P.; Thanvi, K.P.  
 Description : An improved all-steel solar cabinet dryer with a basal area of 1.5 m<sup>2</sup> was fabricated. Tested for its performance by daily measuring the air temperature inside the dryer from 8 a.m. to 5 p.m. the maximum dryer temperature ranged between 70-100 C which came down immediately after being loaded with the produce to be dried depending upon the load initial moisture content and other environmental conditions.  
 Report(s) : Annual Report.  
 Papers Published : -
- 46 Project Title : Design and development of solar continuous grain dryer.  
 Organisation : Central Mechanical Engineering Research Institute, Durgapur-713 209.  
 Project Category : Applied and developmental.  
 Cost : -  
 Duration : -  
 Sponsor(s) : CSIR  
 Investigator(s) : -  
 Description : A vertical bin type continuous solar grain dryer was designed, fabricated and installed. The capacity of the dryer is one ton/day. The grain is dried continuously by flow of hot air at right angles to the vertical bed of grain which moves-downward due to gravity between two perforated sheet chambers. The movement of vertical bed of grains is controlled by manually operated valves and the hot air flow right angle to the grain bed offers higher thermal efficiency. The solar collector designed is of the matrix type, cheap and higher thermal efficiency.  
 Report(s) : Annual Report.  
 Papers Published : -
- 47 Project Title : Use of solar dryer for drying of fruits and vegetables.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-1981  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Kapur, K.L.; and others.  
 Description : Efficiency of solar drier will be studied as compared to sun drying and mechanical dryers for application under different

climatic conditions in rural areas. The solar dryer for this study has been fabricated and preliminary data regarding its temperature capacity etc. have been collected.

Report(s) -  
Papers Published -

48 Project Title : Design and development of fruit and vegetable solar agricultural dryer.  
Organisation : Central Arid Zone Research Institute, Jodhpur-342 003; Division of Wind Power and Solar Energy Utilisation Studies.  
Project Category : Applied and developmental.  
Cost : -  
Duration : -  
Sponsor(s) : ICAR  
Investigator(s) : Garg, H.P. and others.  
Description : A forced convection type of solar dryer for fruits and vegetables was designed and fabricated. It comprises an electric blower connected to six solar air heaters connected in series and joined to a vertical drying chamber with nine equally spaced drying shelves. The dryer was capable of drying 100 kg of chillies from 75% moisture to 8% moisture (weight basis) in one day.  
Report(s) : Annual Report.  
Papers Published : -

49 Project Title : Testing and evaluation of solar batch dryer developed at Jabalpur.  
Organisation : Central Institute of Agriculture Engineering, Nabi Bagh, Bera-sia Road, Bhopal-462 010  
Project Category : Applied.  
Cost : -  
Duration : 1979.  
Sponsor(s) : ICAR  
Investigator(s) : Alam, A, and others.  
Description : The solar batch dryer developed at Jawaharlal Nehru Krishi Vishva Vidyalaya, Jabalpur, was fabricated with modification. The dryer which contains an aeration bin, a solar collector and an electric blower, is being tested and evaluated. In tests with Indori varieties of groundnut (39.5% moisture on weight basis) during September, the recorded temperature rise was low (1.5 C) and as such drying was much lower than in cabinet dryer and sun drying. With modifications carried out for collecting electric motor bodyheat, a mean temperature rise of 6 C was obtained on clear sunny days. With groundnut at 23.6% moisture (weight basis). On cloudy days it was an average of 3.5 C. On the basis of these tests it was concluded that supplemental heating is essential to dry groundnut in this batch dryer. The dryer is now being improved to incorporate a simple pit furnace using groundnut shell as fuel to provide supplemental heating.  
Report(s) : -  
Papers Published : 1. Alam, A. and others. Protective grain dryers. Paper presented at Sixteenth Annual Convention of Indian Society for Agricultural Engineers, IIT, Kharagpur, December, 1980.

50 Project Title : Development of solar dehydrator for potato products.  
Organisation : Central Potato Research Institute, Simla-1.  
Project Category : Applied.  
Cost : -  
Duration : 1978-1982.  
Sponsor(s) : Indian Council of Agricultural Research.  
Investigator(s) : Virendra Singh; Rajendra Singh.



- Description : A solar dehydrator for drying potato products in controlled temperature, air flow and humidity has been developed. It is a cabinet type of dehydrator with its roof as a flat plate collector and uses both non-porous and porous heat absorbers arranged vertically over which the products to be dried can be spread in a single layer. Arrangement for natural cross-ventilation and forced air circulation to drive the evaporated moisture of the products out of the dehydrator has also been made. Potato products like chips, cubes, flakes, etc. have been dried in this dehydrator in a single day and the period of drying is significantly reduced as compared with the traditional open sun-drying. The drying capacity of the dehydrator is about 60 kg of fresh potato products per day. The development of a house-hold dehydrator for low-income group entrepreneurs is also envisaged.
- Report(s) : Annual Report.
- Papers Published : Pamphlet on solar dehydrator for quality potato chips.
- 51 Project Title : Evaluation of chilli drying with solar cabinet dryer and sun-drying.
- Organisation : Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal-462 010.
- Project Category : Applied.
- Cost : -
- Duration : 1978.
- Sponsor(s) : ICAR
- Investigator(s) : Singh, H.P.; Alam, A.
- Description : The solar cabinet dryer of  $2\text{m}^2$  area with 3 mm glass shield was designed and fabricated. Drying of chilli on the solar dryer and by sundrying on various surfaces (tarpaulin), black polyethylene, cement concrete floor and mud were studied during the months of November, January and March. The material densities of the material to be dried were 3, 6, 9 and  $12\text{ kg/m}^2$ . The results showed that when weather hazards are little and less handling is required, sun drying on tarpaulin is more desirable and remunerative. However, when large quantities of chillies are to be dried at high material densities (about  $6\text{ kg/m}^2$ ) the solar cabinet drying is more convenient, hygienic, less vulnerable to weather hazards and economically more rewarding.
- Report(s) : -
- Papers Published : -
- 52 Project Title : Design and development of paddy husk combustor-cum-heat exchanger.
- Organisation : Central Mechanical Engineering Research Institute, Durgapur-713209.
- Project Category : Applied and developmental.
- Cost : -
- Duration : -
- Sponsor(s) : CSIR
- Investigator(s) : -
- Description : The equipment designed earlier was fabricated and installed at FCIS Modern Rice Mills at Durgapur. The combustor has a designed rating of 6000 c/m ( $170\text{ m}^3/\text{min}$ ) of hot air at  $110^\circ\text{C}$  and its performance has been found comparable to an oil fired heating system. Thus, it has the potential of reducing use of imported furnace oil for drying paddy.
- Report(s) : Annual Report.
- Papers Published : -

- 51 Project Title : Development of continuous agitating cooker for canned fruit.  
 Organisation : Central Mechanical Engineering Research Institute, MEDAPO, Madras.  
 Project Category : Applied and developmental.  
 Cost : -  
 Duration : -  
 Sponsor(s) : CSIR  
 Investigator(s) : -  
 Description : This unit is specially suitable to small scale canning units for the processing of canned fruits like pineapple at atmospheric pressure under controlled temperatures of upto 100 C. It minimises manual handling and compared to batch canning process it offers the advantages of fast production, better cooking, low cost and compactness. The production/processing ratio is 700 cans/hr for A 2½ size cans.  
 Report(s) : Annual Report.  
 Papers Published : -
- 54 Project Title : Development of suitable solar cooker for village: performance comparison of five solar cookers.  
 Organisation : Central Arid Zone Research Institute, Jodhpur-342 003; Division of Wind Power and Solar Energy Utilisation Studies.  
 Project Category : Applied and developmental.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Garg, H.P.; Thanvi, K.P.  
 Description : Five types of solar cookers, N.P.L. type paraboloid solar cooker, step reflector type solar cooker, solar steam cooker, hot box type solar cooker and solar oven were tested to obtain comparative data on their properties and performance. Of these, solar oven showed the greatest promise due to its efficiency, ease of operation, ease of construction with local technique and material.  
 Report(s) : Annual Report.  
 Papers Published : 1. Garg, H.P. and others. Performance evaluation of five solar cookers. International Solar Energy Congress, New Delhi, Jan.16-21, 1978.
- 55 Project Title : Development of suitable solar cooker for village use: solar water heater-cum-solar steam cooker.  
 Organisation : Central Arid Zone Research Institute; Jodhpur-342003; Division of Wind Power and Solar Energy Utilisation Studies.  
 Project Category : Applied and developmental.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Garg, H.P. and others.  
 Description : The recently developed system consists of a flat-plate collector, a storage tank and a steam cooker. The absorber, which is designed to give maximum efficiency at minimum cost, consists of a 28 gauge aluminium sheet blackened on the exposed side and wrapped over a set of seven GI pipes (diameter, 19 mm) spaced 10 cm apart. This plate is placed in a mild steel box with a glass top and a 5.0 cm thick fibre glass insulation on the rear side. The absorber is oriented towards south and inclined at an angle of 41 degrees from horizontal at Jodhpur. The storage tank, made up of 20 gauge GI sheet with 10 cm wall spacing filled with fibre glass insulation, is kept on stand such that



its bottom is maintained by a float valve to store about 100 litres of water. In the absence of regular water supply, a bucket size funnel fills the storage tank with level being maintained by an overflow tube. At the top of the collector, a steam cooker is fixed by a 25 mm pipe. The cooker consists of a double walled insulated rectangular box made of 20 gauge GI sheet with an openable insulated lid at the top and a 25 mm diameter pipe welded at the bottom of the inner tank which acts as an inlet for water to the absorber and outlet for steam. Four gate valves are provided at appropriate points to operate the cooker and water heater. The system has given encouraging results and is capable of supplying 100 litres of water at 60-70 C in winter afternoons and 50-60 C on next mornings. It can also be used for cooking or boiling of cereals, rice, potatoes, dals, vegetables, etc. The cost of the system is about Rs.1200/- all inclusive.

Report(s) : Annual Report.

Papers Published : 1. Garg, H.P. and Thanvi, K.P. Studies on solar steam cookers. (Careers in Science, March 1977).

- 56 Project Title : Evaluation of solar cooker.  
 Organisation : Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal-462 010.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979.  
 Sponsor(s) : ICAR  
 Investigator(s) : Prasad, S.  
 Description : Earlier, a solar cooker developed by ATRC, Barsoli was evaluated during winter months. It cooked 250 and 500 gm of rice in containers 1 and 2 in 2.5-3 and 4.5-5 hours respectively; 750-1000 gms placed in containers 3 and 4 could not be cooked. Similar studies were also conducted with various pulses (pigeon pea, lentil and green gram) and potato. It was found that even 100 gms of dhal could not be cooked satisfactorily. During January cooking took 5 hours with 500 gms of potato. However, in summer months a standard meal for a family of 5 (2 adults and 3 children). with 160 gm of rice, 160 gm of pulses and 360 gm of potato (total 1170 gm) was cooked in 3-35 hours. Studies were also conducted on the cooker in terms of intensities of solar radiation at various absorbing surfaces. The two side surfaces accounting for 28% of total absorbing area absorbed only negligible solar radiation. The intensity of other two sides were fairly good. The reduced radiation intensity was also attributed to condensation of water vapour. On the entire surface of the inner gas plate during cooking. Based on these results, it was concluded that the design of the Bardoli solar cooker could be improved by optimising the absorber area for harnessing the required solar energy, using selective coating material of high absorptivity and less emissivity, and by improving the design of container besides addition of a tracking device. The work is in progress.

Report(s) : -

Papers Published : -

- 57 Project Title : Development of a regenerative and smokeless domestic oven.  
 Organisation : Central Mechanical Engineering Research Institute, Durgapur-713209.  
 Project Category : Applied and developmental

- Cost : -  
Duration : -  
Sponsor(s) : CSIR  
Investigator(s) : -  
Description : A modified version of earlier developed domestic oven was designed. The prototype developed consists of a cylindrical core chamber with an angular chamber round it. The latter is closed at the bottom and has a removable top cover. During normal cooking, the chamber which acts as an insulator retains the coal fires and acts as a regenerator because it utilises a portion of the heat energy (which is lost in conventional ovens) to produce coke for subsequent burning as smokeless fuel in the core chamber. The volatile gases that are generated during coke formation in the angular chamber are burnt inside the bed. The heat utilisation capacity of the present is much higher than in conventional ovens. The core chamber is so shaped as to provide efficient draft and holds 1.5 kg of coke while the annual chamber may contain 2 kg of coal fires.
- Report(s) : Annual Report.  
Papers Published : -
- 58 Project Title : Coloured indicator for irradiation verification.  
Organisation : Bhabha Atomic Research Centre, Bombay-470 085.  
Project Category : Applied (Development of labels for identification of control and irradiated products)
- Cost : -  
Duration : -  
Sponsor(s) : Centre  
Investigator(s) : Gupta, B.L.; Bongirwar, D.R.  
Description : See paper published.  
Report(s) : -  
Papers Published : Coloured indicator for irradiation verification. Gupta, B.L. and Bongirwar, D.R. Research & Industry. 19;..1974; 100
- 59 Project Title : Design and development of digital grain moisture meter.  
Organisation : Central Scientific Instruments Organization, Chandigarh-160020.  
Project Category : Applied.  
Cost : Rs. 1.10 lakhs.  
Duration : 1977-1982.  
Sponsor(s) : CSIR  
Investigator(s) : Pathania, D.S. and others.  
Description : A portable digital grain moisture meter, based on the principle of change of capacitance with the change in moisture content, incorporating latest CMOS IC technology has been developed. Constant weight technique has been used in the sensor. It operates on a 9 volt battery and is calibrated for the moisture measurement in grains. The apparatus is portable, compact, light weight and easy to operate and useful for procurement agencies, storage houses, food corporations, food laboratories, agricultural institutions and similar other agencies. A fully engineered model has been developed and its know how has been passed on to the industry for commercial exploitation. (M/s AIMIL, Delhi, have taken the know how, through NRDC for commercial exploitation).
- Report(s) : -  
Papers Published : -



- 60 Project Title : Performance of grain flour mills.  
 Organisation : Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal-462 010.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977.  
 Sponsor(s) : ICAR  
 Investigator(s) : Srivastava, P.K.  
 Description : The traditional grinder (hand stone grinder) of low capacity imparts drudgery to the operator. A mini grain mill suitable for village level for wheat milling and gram pulse splitting operations was tested and compared with a commercial flour mill (10 hp) and a hand grinder. The cost of the mini mill was Rs. 1,800/- as compared to that of the commercial mill which was Rs. 10,000. It was observed that the mini burr mill could produce 10 kg/hr of wheat flour and 30 kg/hr of dhal as compared to 1.5 kg/hr wheat flour and 10 kg/hr of dhal milled by handgrinder. The mini mill was economical for these primary processing operations and could give higher cost benefit ratio.  
 Report(s) : -  
 Papers Published : -
- 61 Project Title : Mini grain mills for attrition industry at the farm level.  
 Organisation : Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal-460 010.  
 Project Category : Applied  
 Cost : -  
 Duration : 1978  
 Sponsor(s) : ICAR  
 Investigator(s) : Tarun Kapur  
 Description : A long time test was conducted on the small grain mill for splitting Bengal gram into dhal and milling chick pea into flour (besan). The clearance between stones was 5 mm. The feed rate and moisture content for splitting pulses and milling chickpea into flour were respectively 29 kg/hr and 9.75 % (weight basis) and 10 kg/hr and 7.8% (weight basis). The mill was also tried with spices (coriander, turmeric and chillies) and pulses but this required a modification of the feeding system. The modified mill tried with turmeric and chillies still showed a problem of choking because of limited size of screw conveyor casing. Therefore, the spices were first manually broken into smaller pieces in a mortar-pestle. Overnight soaking followed by sun drying for 4 hours reduced labour required for breaking in the case of turmeric.  
 Report(s) : -  
 Papers Published : -
- 62 Project Title : Operational research trials on mini grain mill.  
 Organisation : Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal-460 010.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1978.  
 Sponsor(s) : ICAR  
 Investigator(s) : Bisht, B.S. and others.  
 Description : Mini burr mill and mini hammer mill were evaluated for functional performance (with cereals, pulses and with coriander) and compared with that of manually operated burr grinders used in villages as well as commercial flour mill and commercial spice mill. The study indicated that mini burr mill did attract the

interest of farmers in view of the obvious advantages of overall cost-benefit values at the village level.. Effects are under way to monitor the adaption rate.

- Report(s) : -  
Papers Published : -
- 63 Project Title : Automatic ripened banana slicing machine.  
Organisation : Bhabha Atomic Research Centre, Bombay-470085.  
Project Category : Applied (Unit designed and fabricated at FIPLY).  
Cost : Approx. Rs. 10,000/-.  
Duration : Working for last 3 years without any problems.  
Sponsor(s) : Centre.  
Investigator(s) : Bongirwar, D.R.  
Description : The machine consists of a hopper power driven conveyor belt, a variable speed camoperated steel wire meshed arrangement for slicing the bananas as it falls from the conveyor and other accessories.  
Report(s) : -  
Papers Published : -
- 64 Project Title : Development of low capacity improved oil expeller.  
Organisation : Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal-460010.  
Project Category : Applied.  
Cost : -  
Duration : 1979.  
Sponsor(s) : ICAR  
Investigator(s) : Jaswant Singh.  
Description : It was found during preliminary studies that most of the oil extraction was carried out in traditional, Kholu power ghanies, mechanical expellers and solvent extractors where in 14%, 12% 7% and 1% of oil was lost respectively. In ghanies and expellers, the main reasons for low recovery were inadequate treatment given to oilseeds before extraction and improper adjustment of the machinery. Efforts are therefore under way to develop a low capacity improved oil expeller suitable for rural areas after determining the optimum parameters for oil recovery.  
Report(s) : -  
Papers Published : -
- 65 Project Title : Boruah continuous roller.  
Organisation : Tea Research Station; Tocklai Experiment Station, Jorhat-385 008.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Tea Research Association.  
Investigator(s) : Baruah, T.C.  
Description : Three prototypes were successfully developed and released for commercial manufacture. The machines which have been installed at different places are being tested.  
Report(s) : Annual Report.  
Papers Published : -



- 66 Project Title : Design and fabrication of a continuous extraction plant for instant tea.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Plantation Products and Flavour Technology, and Process Development and Design Discipline.  
 Project Category : Applied.  
 Cost : Rs. 3,35,000/-.  
 Duration : Jan.1975 - Dec.1979.  
 Sponsor(s) : Tea Board.  
 Investigator(s) : Ramanathan, P.K. and others.  
 Description : Unit operations for the manufacture of instant tea from green tea leaves were standardised to get an acceptable instant tea power. Experiments were conducted at estate level using indigenous equipment with fermented leaves got from a tea factory. The quality of the product has been evaluated.  
 Report(s) : Final.  
 Papers Published : -
- 67 Project Title : Development of withering equipment.  
 Organisation : Tea Research Association; Tocklai Experiment Station; Jorhat 785 008.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Tea Research Association.  
 Investigator(s) : Baruah, T.C.  
 Description : A new continuous and compact withering system has been developed. Minor defects and inaccuracies found on tests conducted for its mechanical performance have been rectified. Trials with tea leaves are in progress.  
 Report (s) : Annual Report.  
 Papers Published : -
- 68 Project Title : Design and development of a fixed bed counter extractor for coffee.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Process Development Discipline.  
 Project Category : Applied.  
 Cost : Rs. 14,000/-.  
 Duration : June 1979 - May 1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Ramakrishna, P. and others.  
 Description : A six stage countercurrent extraction battery was designed for a capacity of 350 gm of R&G coffee for column. The multi value interconnections are designed for continuous operation of 5 columns at a time with one column under spent discharging and fresh R&G coffee filling. Experiments were also conducted in a 5 stage counter-current extractor with a cycle time of 18-20 min. It was observed that there was considerable loss of heat not only from the jacket of the column but also from the interconnection. Therefore, it was proposed to put steam to the jackets of the columns and also to provide intermittent heating by modifying the interconnections with a steam jacket for heating.  
 Report(s) : -  
 Papers Published : -
- 69 Project Title : Design and development of papad making machine.  
 Organisation : Central Mechanical Engineering Research Institute, MERADO, Madras.  
 Project Category : Applied and developmental.  
 Cost : -

- |                  |   |  |
|------------------|---|--|
| Duration         | : |  |
| Sponsor (s)      | : | CSIR   |
| Investigator (s) | : |  |
| Description      | : | A semi-automatic papad making machine has been designed and developed. The machine can produce and dry square papads using the extrusion technique for papad sheeting. The dough is continuously produced in a kneader mixer. The drying is on a conveyor moving in the drying chamber. Suitable cutter system has also been incorporated in the line for producing the papads to required size. |
| Report (s)       | : | Annual Report.   |
| Papers Published | : | -  |
- 70 Project Title : Development of crystal ice machine.
- Organisation : Central Mechanical Engineering Research Institute, Durgapur-713209.
- Project Category : Applied and developmental.
- Cost : -
- Duration : -
- Sponsor (s) : CSIR
- Investigator (s) : -
- Description : The crystal ice maker that has been designed is a continuous machine producing about 100 kg of crystal ice per day.
- Report (s) : Annual Report.
- Papers Published : -
- 71 Project Title : Development of tip ice machine.
- Organisation : Central Mechanical Engineering Research Institute, Durgapur-713209
- Project Category : Applied and developmental.
- Cost : -
- Duration : -
- Sponsor (s) : CSIR
- Investigator (s) : -
- Description : A tip ice making machine meant for beverage sellers, hotels, bars and restaurants, laboratories, etc. was fabricated and tested. The machine is self contained, compact, portable, completely automatic and can operate on domestic power supply. The ice produced can be stored and dispensed hygienically. The capacity of the machine is 40-50 kg of ice per hour and the storage capacity is about 1/3 of 24 hours production.
- Report (s) : Annual Report.
- Papers Published : -
- 72 Project Title : Ice flake machine for perishable foods.
- Organisation : Bhabha Atomic Research Centre, Bombay-470085.
- Project Category : Applied (Unit designed and fabricated at FIPLY)
- Cost : Approx. Rs.10,000/-.
- Duration : Working for last 4 years without any problem.
- Sponsor (s) : Centre.
- Investigator (s) : Bongirwar, D.R.
- Description : -
- Report (s) : -
- Papers Published : 1. Bongirwar, D.R. Development of ice flake machine for perishable foods. Proc. of 7th National Symp. on refrigeration and Air conditioning, I.I.T., Kharagpur, pp.117-120, 1980.
- 73 Project Title : Ice crusher for slicing big ice slabs.
- Organisation : Bhabha Atomic Research Centre, Bombay-470085.
- Project Category : Applied (The ice crusher was designed and fabricated in the Divisional Workshop at FIPLY)



- Cost : Approx. Rs.2,000/-.
- Duration : -
- Sponsor(s) : Centre.
- Investigator(s) : Bongirwar, D.R.
- Description : The unit consists of a crusher portion driven by an electric motor in a chute through which big ice slab is slipped in for crushing purpose. As soon as the pointed pins fitted on crusher portion hits the ice slab the ice crushes into form of small pieces which could then be effectively used for preservation of perishable foods.
- Report(s) : -
- Papers Published : -
- 74 Project Title : Design and fabrication of laboratory fermentors.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Microbiology and Fermentation Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 1,85,400/-.
- Duration : June 1977-March 1979
- Sponsor(s) : Institute.
- Investigator(s) : Asthana, H.N. and others.
- Description : An automated, modular and compact laboratory fermentor with indigenous components was designed and a prototype unit fabricated. The salient features of the fermentor are: interchangeable fermentor vessels of 2 and 10 litres working volumes; magnetically coupled agitation drive; electronic air flow monitor; dual mode pH control; temperature and foam controls; dissolved oxygen monitor; continuous culture console; six point recorder; computer compatibility of digital read-out of temperature, pH, dissolved oxygen, agitation speed and airflow rate; audio-visual announcement system for power, air and cooling water failures with operator's call for pH and foam control systems. The unit was extensively tested to improve the control systems.
- Report(s) : Final.
- Papers Published : -
- 75 Project Title : Modification to replace electric heatings in leaf cup making machine to work on charcoal or heating by leaf trimming.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Packaging Discipline.
- Project Category : Applied.
- Cost : Rs. 29,100/-.
- Duration : June 1982 - June 1983.
- Sponsor(s) : Institute.
- Investigator(s) : Crown, J.K.; Veerraju, P.
- Description : The existing machine was modified and a charcoal fire box was incorporated below the female die. Though it is possible to dry the leaf cup by this method it is taking too long a time to dry, as the female die is not heating fast. Improvements in this direction are contemplated.
- Report(s) : -
- Papers Published : -

#### Dairy Equipment

- 76 Project Title : Development of fluidized bed casein dryer.
- Organisation : National Dairy Research Institute, Karnal-132 001.
- Project Category : Applied.
- Cost : -

Duration : 1980-82  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Rawal, S.R. and others.  
 Description : The project aims to study the drying characteristics of casein develop a casein dryer; and evaluate its performance. A small laboratory model has been devised which consists of a heater, air compressor and a glass column along with the arrangement for measurement of air flow rate, pressure and temperature. Casein samples were dried to approximately 8% moisture under optimum fluidized conditions with variations in air temperature.

Report(s) : -  
 Papers Published : -

77 Project Title : Development of instrument for the measurement of powder loss from spray drying plant.  
 Organisation : National Dairy Research Institute, Karnal-132001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1978-81.  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Agrawala, S.P. and others.  
 Description : The project envisages the design and development of an instrument for drawing isokinetic sample from exhaust of spray dryer. It also suggests the measures for reduction of powder loss to commercial plants. The portable instrument comprises of three parts: (i) a box of 20 x 40 x 40 cm which contains the glass cyclone, filter assembly manometer, valves collection dish, etc.; (ii) one box of velometer (15 x 30 x 30 c); and (iii) a portable blower.

Report(s) : Final.  
 Papers Published : 1. Agrawala, S.P. and others. An improved instrument for the measurement of powder losses from spray drier exhaust. (Indian Dairyman 32(6); 1980; 479).

78 Project Title : Heat and mass recovery system for the spray dryer exhaust.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1982-1983  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Bikram Kumar.  
 Description : The project is taken up to find out ways and means to recover, the heat from exhaust of spray drying plant to recover the stack losses, and to develop process parameters for scale-up designs.

Report(s) : -  
 Papers Published : -

79 Project Title : Development of low-cost UHT processing equipment.  
 Organisation : National Dairy Research Institute, Karnal-132001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-83.  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Agrawala, S.P. and others.  
 Description : The design and fabrication of a pilot-plant UHT equipment has been envisaged and the physico-chemical and microbial changes in buffalo milk during processing and storage are studied. The experimental prototype UHT equipment is based on direct steam injection system.



- Report(s) : -  
Papers Published : -
- 80 Project Title : Studies and improvement of clarifier for ghee.  
Organisation : National Dairy Research Institute, Karnal-132001.  
Project Category : Applied.  
Cost : -  
Duration : 1978-81.  
Sponsor(s) : Indian Council of Agricultural Research.  
Investigator(s) : Zaidi, A.H. and others.  
Description : The project aims to develop a mechanized clarifier working on centrifugal action which can be integrated with continuous ghee making equipment. This intends to replace the conventional batch procedure of cloth or bag filtration. A basket centrifuge of 200 kg/hr is designed and provision is made for easy cleaning and continuous scrapping of residue in the design.
- Report(s) : -  
Papers Published : 1. Zaidi, A.H. and others. Determination of particle size distribution and density of ghee residue for the development of centrifugal ghee clarifier. (Indian J. Dairy Sci. 33; 1980; 244).  
2. Zaidi, A.H. and others. Ghee drainage through residue cake and its application in the design of filtering centrifuge. (Indian J. Dairy Sci. 33; 1980; 24)
- 81 Project Title : Compressed air/inert gas agitation in milk and ghee.  
Organisation : National Dairy Research Institute, Karnal.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Indian Council of Agricultural Research.  
Investigator(s) : Dhuria, R.S. and others.  
Description : A design for compressed air agitation equipment was standardised and its effect on quality of milk and milk products studied. Two tanks of different geometrics were designed with nozzles located suitably to introduce air at minimum pressure required for proper agitation. In the trials conducted at laboratory levels, it was found that distributing the air at 2 points through nozzle for agitation had better efficiency, less free fat rise, more uniform fat distribution and minimum foam formation. A flow rate of air at 250 cc/ sec was found sufficient for agitation in the tank at all levels upto 20 kg milk storage.
- Report(s) : -  
Papers Published : -
- 82 Project Title : Development of continuous ghee making equipment.  
Organisation : National Dairy Research Institute, Karnal.  
Project Category : Applied.  
Cost : -  
Duration : 1980-.  
Sponsor(s) : Indian Council of Agricultural Research.  
Investigator(s) : Abichandini, H. and others.  
Description : An equipment has been developed on falling film scraped surface heat exchange principle with a capacity to produce 100 to 150 kg ghee per hour. The total metallic surface area of the plant is 6.84 sq.m. These steam and electrical energy consumptions are 0.38 kg and 0.01 kwh per kg of butter. The optimum speed is 180 rpm. The ghee is found to conform to the standards prescribed under Agmark rules. There was no peroxide development in ghee samples stored for 45 days, but a slight peroxide

development (0.5-1.0) took place in ghee stored for 90 days.

Report(s) : -  
Papers Published : -

83 Project Title : Development of a continuous chhana making machine.  
Organisation : National Dairy Research Institute, Karnal-132001.  
Project Category : Applied.  
Cost : -  
Duration : 1977-1981.  
Sponsor(s) : Indian Council of Agricultural Research.  
Investigator(s) : Aneja, A.P. and others.  
Description : Collection of basic data to design and fabricate a stainless steel machine for the continuous production of chhana and to standardize the technique for large scale production of chhana have been attempted. Trials were done with skim milk and with whole milk to see the performance of the equipment. Complete coagulation of milk was observed in a residence period of 15 seconds. Subsequently an improved steam mixing chamber and a mechanical strainer were fabricated and integrated with the unit.

Report(s) : Final  
Papers Published : 1. Aneja, A.P. and others. An improved process for continuous production of chhana. (Asian J. Dairy Res. 1; 1982; 41).  
2. Kishore, N. and Aneja, V.P. Continuous mechanical strainer for chhana. J. Inst. Eng. 62(1); 1981; 9.  
3. Kishore, N. and Aneja, V.P. Draining characteristics of chhana with mechanical devices. J. Inst. Eng. 62(1); 1981; 15.

\*72

84 Project Title : Development of Khoa making machine.  
Organisation : National Dairy Research Institute, Karnal-132001.  
Project Category : Applied.  
Cost : -  
Duration : 1978-81.  
Sponsor(s) : Indian Council of Agricultural Research.  
Investigator(s) : Sawhney, I.K. and others.  
Description : A jacketted hemispherical pan which can operate under variable temperatures has been designed and fabricated. Trials on khoa making in the pan were carried out. A detachable foam column has been devised to increase the capacity of pan. A battery of three pans of small size are being fabricated to facilitate continuation in khoa making. Suitable frame to hold these and a furnace has been designed.

Report(s) : Final.  
Papers Published : 1. Sawhney, L.K. and others. Development of village level khoa pan. (J. Inst. Eng. India. 61; 1980; 13).

85 Project Title : Studies on utilisation of solar energy for hot water supply to the dairy plants.  
Organisation : National Dairy Research Institute, Karnal-132001.  
Project Category : Applied.  
Cost : -  
Duration : 1977-1980.  
Sponsor(s) : Institute.  
Investigator(s) : Verma, R.D. and others.  
\*74

86 Project Title : Study of the existing layouts for chilling centres and market milk plants to collect data which will lead to ultimate standardization of such layouts based on optimum requirements.  
Organisation : National Dairy Research Institute, Southern Regional Station, Adugodi, Bangalore- 560030.  
Project Category : Applied.  
Cost : -  
Duration : 1977-1979.  
Sponsor(s) : Institute  
Investigator(s) : Arora, D.R.; Venkataramaiah, M.S.  
\*76



- 87 Project Title : Development of equipment for chilling milk under village conditions.  
 Organisation : National Dairy Research Institute, Karnal-132001; Dairy Engineering Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1973-1983.  
 Sponsor(s) : -  
 Investigator(s) : Abichandani, H. and others.  
 Description : A chilling equipment which is easy to operate and can run on any source of heat was developed and modified after several tests. The revised version consists of two generators and natural draft aircooled condenser and evaporator is being tested against leaks.  
 Report(s) : Annual Report.  
 Papers Published : -
- 88 Project Title : Fouling of milk contact surfaces.  
 Organisation : National Dairy Research Institute, Karnal-132001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979-1981  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Aneja, V.C.; Sarma, S.C.  
 Description : A small laboratory plate heat exchanger was modified to estimate the reduction in heat transfer rates due to fouling in plate heat changers. The modified equipment consists of a jacketed supply tank with agitator, temperature controller, circulating pump, rotameter, heat exchanger and other accessories. The trials are, however, yet to be carried out.  
 Report(s) : -  
 Papers Published : 1. Jaspal Singh and Aneja, V.P. Effect of acidity and heating time on fouling in heat exchangers. (J. Inst. Eng. India. 62(1); 1981; 12).
- 89 Project Title : Development of electrical deacidification equipment of milk.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1982-1983.  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Dodeja, A.K. and others.  
 Description : The objective of the project are to neutralise the acidity developed and make it for heat processing; to develop process parameters to predict scale up equipment; and to develop a prototype equipment for 100 litre/hr. Capacity to link with the developed UHT plant.  
 Report(s) : -  
 Papers Published : -
- 90 Project Title : Development of village level equipment for dehydrating milk.  
 Organisation : National Dairy Research Institute, Karnal-132001; Dairy Engineering Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979-81  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Bikram Kumar and others

- Description : A self-contained system using conventional fuel sources is being developed. For this purpose, a processing drum and a steam generating drum was fabricated. A suitable furnace to burn conventional fuels, was designed and constructed using refractory bricks.
- Report(s) : -
- Papers Published : 1. Anap, G.R. Utilisation of conventional energy sources at village level dairy industry. Paper presented at Dairy Industry Conference, Pune, 21-23 March 1980.  
2. Bikram Kumar and others. Design characteristics of village level milk dehydrator. J. Inst. Eng. 61; 1980; 1.
- 91 Project Title : Milk and vegetable oils vending design.  
Organisation : National Dairy Development Board, Anand-388001.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Board.  
Investigator(s) : -  
Description : The bulk-vending system first introduced in Delhi in 1974 was further improved to reduce maintenance cost. A manual vending system using fibre glass reinforced plastic containers of 200-400 litre capacity was subjected to trials and the basis for suitable modification and standardisation of the system was established. The units were got fabricated by a number of small scale manufacturers and 400 units were supplied. Efforts are on hand to develop a manual unit for dispensing edible also such as groundnut, soybean, palm oil, etc.
- Report(s) : -
- Papers Published : -
- 92 Project Title : Studies on the utilisation of solar energy.  
Organisation : National Dairy Research Institute, Karnal.  
Project Category : Applied.  
Cost : -  
Duration : 1977-1982  
Sponsor(s) : Indian Council of Agricultural Research  
Investigator(s) : Verma, R.D. and others.  
Description : Solar water heaters (flat plate collectors) with aluminium panels connected in parallel, were studied for thermal efficiency. The connection of panels in parallel is a new modification to overcome air-locking problem experienced when panels were connected in series. The maximum temperature attained was 67 C at mass flow rate of 10 kg/hr.
- Report(s) : -
- Papers Published : 1. Reddy, J.M.; Verma R.D. Performance evaluation of solar collectors used in dairies. J. Inst. Eng. India. 61; 1980; 5 .
- 93 Project Title : Development of solar dryer.  
Organisation : National Dairy Research Institute, Karnal-132001.  
Project Category : Applied.  
Cost : -  
Duration : 1980-  
Sponsor(s) : Indian Council of Agricultural Research.  
Investigator(s) : Venkataramiah, M.S.  
Description : A solar drier costing Rs. 800/- with locally available materials has been constructed. The collector has an area of 17.28 sq.mts has drying chamber of 0.9 m<sup>3</sup> at one end and the air vent of 0.7 sq.mts. at the other. The working efficiency of the



drier has been evaluated in parallel with fodder crops dried by direct exposure to sun as the traditional hay making.

Report(s) : -

Papers Published : -

### Fisheries and Fish Processing Equipment

- 94 Project Title : Development of operation of pilot plants and equipments.  
 Organisation : Central Institute of Fisheries Technology, Matsyapuri, Cochin-682029.  
 Project Category : Applied.  
 Cost : Rs. 10,30,000/-.  
 Duration : January 1974-December 1981.  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Chakraborty, P.K. and others.  
 \*80
- 95 Project Title : Development of equipment for fishing, fish handling and fish storage on board fishing vessel.  
 Organisation : Central Institute of Fisheries Technology, Matsyapuri, Cochin-682029.  
 Project Category : Applied.  
 Cost : Rs. 90,000/-.  
 Duration : 1973-1980.  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Namboodiri, K.S. and others.  
 \*81.
- 96 Project Title : Development of machineries required for fish freezing and canning industries.  
 Organisation : Central Institute of Fisheries Technology, Matsyapuri, Cochin-682029.  
 Project Category : Applied.  
 Cost : Rs. 1,48,000/-.  
 Duration : January 1973-December 1980.  
 Sponsor(s) : ICAR  
 Investigator(s) : Pillai, S.A. and others.  
 \*82
- 97 Project Title : Development of control and measuring instrument for fishing and fish processing.  
 Organisation : Central Institute of Fisheries Technology, Matsyapuri, Cochin-682029.  
 Project Category : Applied.  
 Cost : Rs. 56,800/-.  
 Duration : 1973-1980.  
 Sponsor(s) : Indian Council of Agricultural Research New Delhi.  
 Investigator(s) : Pillai, S.A. and others.  
 \*84
- 98 Project Title : Development of a fish meat picking machine.  
 Organisation : Bhabha Atomic Research Centre, Bombay-470085.  
 Project Category : Applied (The fish meat picking machine was developed for on-going R&D work in the division. The machine was designed and fabricated in the divisional workshop at FIPLY).  
 Cost : Approx. Rs.10,000/-.  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Bongirwar, D.R.

- Description : The machine consists of a power driven conveyor belt going below a power driven stainless steel perforated drum provided with rotating scraper conveyor inside the drum. As soon as the fish from which meat portion is to be separated from its trash and bones is fed to the conveyor, the friction and pressure forced exerted on fish by conveyor and perforated drum will take out the meat portion from the body of fish inside the drum, and the scraper conveyor inside the drum will collect the meat portion separately and trash and bones will pass away at other end of conveyor.
- Report(s) : -
- Papers Published : -
- 99 Project Title : Solar dryer for marine and farm products.
- Organisation : National Institute of Oceanography, Dona-Paula-403004, Goa.
- Project Category : Applied and developmental.
- Cost : -
- Duration : -
- Sponsor(s) : CSIR
- Investigator(s) : -
- Description : The cabinet type solar dryer developed is based on the earlier developed multi-surface solar still. The working model of the dryer has a floor area of 0.5 m<sup>2</sup> and is capable of drying 50 large size coconuts in about 48 hrs as against 9 days taken by open sun drying. For grapes and red chillies, however, drying took 72 hours. An important feature of the dryer is the detachable metallic hanger which accelerates the drying process. The feasibility of drying marine products like fish, shrimps, etc. is being studied.
- Report(s) : Annual Report.
- Papers Published : 1. Anand, S.P. A solar dryer for marine-cum-farm products. Mahasagar - bulletin of the National Institute of Oceanography 13; 1980; 383-384.

### PACKAGING

- 100 Project Title : High moisture and gas barrier flexible packaging material.
- Organisation : Britannia Industries Ltd; Research and Development Division, Plot 112, Street 13, Moral MIDC, Andheri East, Bombay-400093.
- Project Category : Applied
- Cost : -
- Duration : Continuous.
- Sponsor(s) : Company.
- Investigator(s) : Sidhanty, A.R.; Varma, V.K.
- Description : Polypropylene film as a packaging material has been developed. Films of different specifications were tested on packing machines and a suitable film with adequate functional properties has been selected.
- Report(s) : Report for company circulation only.
- Papers Published : -
- \*89
- 101 Project Title : Design of gas packaging machine for packaging oxygen moisture and light sensitive food materials in flexible packaging materials.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Packaging Technology Discipline.



- Project Category : Applied.  
 Cost : Rs. 16,200/-.  
 Duration : Nov.1980-April 1981.  
 Sponsor(s) : Institute.  
 Investigator(s) : Gnanasekaran, K.S.; Ramanathan, P.K.  
 Description : The two imported gas packaging machines available in the Institute were studied in detail with reference to their design and constructional characteristics. Based on this study design has been worked out. The availability of standard parts required for the proposed machine is also found out.  
 Report(s) : -  
 Papers Published : -
- 102 Project Title : Some investigations on the physico-chemical characteristics of indigenous flexible packaging materials based on metal foils, cellulose and polymers, etc. and evaluation of and testing of packaging materials and packages for industry and other public organisations.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Packaging Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,53,600/-.  
 Duration : April 1979 - March 1981.  
 Sponsor(s) : Institute.  
 Investigator(s) : Vijayendra Rao, A.R. and others.  
 Description : Influence of different environment like edible oils and temperatures on mechanical properties and heat seal strength of polypropylene and HDPE was studied at normal (27 C) and accelerated storage (38 C). There was periodic decrease in tensile and seal strength with groundnut oil, the losses being higher at 38 C than at 27 C. Water vapour density at 38 C increased in LDPE and HDPE while no change was observed with polypropylene. Storage studies with raw groundnut oil in polypropylene and HDPE pouches (500 ml capacity at 27 C and 38 C gave an acceptability rating of upto 3 months at 38 C and 4 months at 27 C. Peroxide value and FFA remained within acceptable limits. Studies on the effect of food simulating solutions (5% citric acid, 5% NaCO<sub>3</sub>, olive oil with oleic acid (2%), 50% alcohol and distilled water) on polypropylene after storage at 45 C for 10 days showed specific changes in tensile strength, WVTR, burst and tear properties.  
 Report(s) : Final.  
 Papers Published : -
- 103 Project Title : Design and development of functional consumer flexible packages for fatty foods and assessment of plastic packaging materials for food packaging.  
 Organisation : Central Food Technological Research Insittute, Mysore-570013; Packaging Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs.2,04,800/-.  
 Duration : June 1980 - May 1983  
 Sponsor(s) : Institute.  
 Investigator(s) : Balasubramanyam, N. and others.  
 Description : Inexpensive and functional unit packages for oxygen sensitive and fatty foods are being designed and developed from available indigenous packaging materials and extensive storage studies conducted on them to determine optimum levels of headspace oxygen, vacuum and gas packaging schedules, as also to predict the shelf-life of the products stored in them. Suitability of

various flexible materials will be evaluated for use with the above types of foods as well as to assist government bodies like CCPS, ISI in according clearance and drawing up standards for these materials.

- Report(s) : -  
 Papers Published : 1. Balasubramanyam, N. and others. Packaging and storage studies of ground cumin seeds in flexible consumer packages. (Indian Spices. 18(1); 1981; 1).
- 104 Project Title : Preservation of fruits and vegetables and their juices.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-1983.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Kapur, K.L. and others.  
 Description : Studies are being conducted on the utilisation of flexible packaging materials, like polystyrene, polypropylene and laminates such as tetra and meta packs, for in-pack processing and preservation of fruits and vegetables and their juices.  
 Report(s) : -  
 Papers Published : -
- 105 Project Title : Development of bulk packages for storage and transportation of commercially important fruits.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Packaging Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 63,000/-.  
 Duration : June 1980-June 1982  
 Sponsor(s) : Institute.  
 Investigator(s) : Anandaswamy, B. and others.  
 Description : The project was concerned with design of layer containers using less of wood and to substitute wood with alternatives like date palm mat, jute cloth and corrugated fibre board, wherever possible, without affecting the physical and strength characteristics. Several raw types of different sizes were developed and tested. As a prerequisite to design a bulk transport container steps for prepackaging were worked out. Fresh carrots prepackaged in 0.5 kg lots in polyethylene bags of specific gauge, size and aeration were found to store satisfactorily for 15-18 days at 27 C and 65 + 2% RH. Use of flexible film liners of LDPE and Hessian liners have also been tried on produce taken in woven bamboo basket. Two new design of composite packaging cases (for apples) made of wood with facings of corrugated fibre board and fibre board - palmyra mat respectively. The designs allow for dismounting of panels thus offering advantages in transportation besides savings of 40-50% in wood. Simulated transportation trials have been conducted and the containers are now being evaluated at field level. A double basket assembly consisting of an inner and outer basket has also developed and tried. A comparative assessment of these different packaging patterns could not be made because of heavy condensation and consequential microbial spoilage.  
 Report(s) : -  
 Papers Published : -



- 106 Project Title : Evaluation of suitability of alternate food grade containers (polyethene) for bulk storage of fruit pulp and juice.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Fruit and Vegetable Technology.
- Project Category : Applied.
- Cost : Rs. 92,000/-.
- Duration : April 1980-April 1982
- Sponsor(s) : Institute.
- Investigator(s) : Nanjundaswamy, A.M. and others.
- Description : Suitability of plastic containers to replace the current containers, namely, wooden barrels and glass carboys was studied. Small HDPE bottles proved as effective as glass jars for packing tomato paste and pineapple jam. No off-flavour was noticeable for 1 month in the case of former and 2 months with the latter. Incorporation of a permitted preservative (500-750 ppm) improved storage life.
- Report(s) : -
- Papers Published : -
- 107 Project Title : Improvement and development of transport packages forms from traditional indigenous materials.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Packaging Technology Discipline.
- Project category : Applied.
- Cost : Rs. 69,240/-.
- Duration : January 1981-December 1982
- Sponsor(s) : Institute.
- Investigator(s) : Veerraju, P. and others.
- Description : Date palm leaf mat of modular strip type, palmyra mat of continuous diagonal weave type and Rushmats (from Kora grass) of rectangular block type were studied for their physical weave structure and tested for ease of creasing slotting and closing to make them into boxes. Date palm leaf mats and palmyra leaf mats could be creased by crimp folding but could not be slotted. All the three types could be joined at body by string stitching. A prototype box of 250 mm cube was fabricated from date palmyra leaf mat and rush mats and examined to carry canned and bottled foodstuffs. The former required corrugated fibre board plates on top and bottom panels for canned foods while the latter required CFB panels on all the sides.
- Report(s) : -
- Papers Published : -
- 108 Project Title : Comparative merits of different polyethylene materials with regard to permeability of oxygen, moisture and external odours.
- Organisaton : National Dairy Research Institute, Southern Regional Station, Audugodi, Bangalore.
- Project Category : Applied.
- Cost : -
- Duration : 1981-1982.
- Sponsor(s) : ICAR
- Investigator(s) : Bhat, G.S.; Rama Murthy, M.K.
- Description : The packaging material tried were LDPE, HDPE, metallised polyester films and laminates. Metallised polyester films formed a perfect barrier against light and was also of low cost; thus this material was studied in detail. It was found that this material had also excellent barrier properties against oxygen, moisture, flavour and odour and was highly suitable

for packaging of ghee. However, the storage temperature should preferably be below 45 C as above that temperature sweating of fat takes place.

Report(s)  
Papers Published:

109 Project Title : Development of a suitable code printing device for flexible packaging materials.  
 Organisation : Britannia Industries Ltd; Research And Development Division, Plot, 112, Street 13, Marol MIDC, Andheri East, Bombay-400093.  
 Project Category : Applied.  
 Cost : -  
 Duration : Closed.  
 Sponsor(s) : Company.  
 Investigator(s) : Sidhanty, A.R.; Varma, V.K.  
 Description : Suitable printers developed indigenously and performance found satisfactory.  
 Report(s) : Report for company circulation only.  
 Papers Published : -  
 \*91

110 Project Title : Design and development of shipping containers for transport of fresh fruits.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Packaging Technology Discipline.  
 Project Category : Applied and developmental.  
 Cost : Rs. 1,73,200/-.  
 Duration : July 1978-June 1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Ananda Swamy. B.  
 Description : A bulk container for transport of fruits was designed and fabricated. Performance tests were carried out with these containers before introducing them for regular commercial use.  
 Report(s) : Final.  
 Papers Published : -  
 \*86

111 Project Title : Design and development of insect resistant unit and bulk flexible packages for the packaging of floury foods.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Packaging Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,75,000/-.  
 Duration : June 1978-June 1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Ananda Swamy, B.  
 Description : Several packaging films like LDPE, HDPE, polypropylene, MXXT cellophane and laminates of MXXT/LDPE, polyester, LDPE, metabolised polyester LDPE and PE/cello/foil/LDPE of different gauges were tested against Sitophilus, Rhizopertha, Stegobium and Tribolium insects. Some of the films were damaged by Sitophilus but not by other insects. Creased films were more susceptible. The organic fumigants permeated into most material better than phosphine. In studies on packaging of spices like turmeric and coriander, there were variations in shelf-life but the maximum was 4 months after which there was insect penetration.  
 Report(s) : Final.  
 Papers Published : 1. Kumar, K.R. and others. Integrated approach to insect resistant packages. (Presented at Ahara 82: International Food Conference, Bangalore, May 1982).



- 112 Project Title : Design and fabrication of die heads and assemblies suitable to produce larger shallow plates and deeper cups from areca sheath.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Packaging Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 29,300/-.  
 Duration : April 1979-December 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Veerraju, P. and Crown, J.  
 Description : Die heads designed earlier for making rectangular and hexagonal leaf cups were modified to fix them rigidly and for easy interchange and maintenance. A new die head assembly was designed and fabricated for making leaf trays double the size of earlier rectangular Donne (leaf cups), the same has been tested and design drawings released for commercial exploitation. Another die assembly was developed for deep rectangular tea cups from Bauhinea, banana and paper, and modified to make cups from areca sheaths.  
 Report(s) : Final  
 Papers Published : -
- 113 Project Title : Improvements on physical properties of conventional metal containers.  
 Organisation : Central Food Technological Research Institute, Mysore-4570013; Packaging Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 55,310/-.  
 Duration : June 1979-May 1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Mahadevaiah, M. and others.  
 Description : A simple unit for coating the external surface of the can seam ends to prevent rusting in differential tin plate was developed. Speed of lacquer coating, dilution of lacquer and drying tune were worked out. Storage studies of the coated cans were conducted and some further improvement were suggested.  
 Report(s) : Consolidated Report.  
 Papers Published : -
- 114 Project Title : Development of technology for use of indigenous tinplate in food industries.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Packaging Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 5,12,300/-.  
 Duration : July 1982-June 1984.  
 Sponsor(s) : Institute and Government.  
 Investigator(s) : Mahadevaiah, M. and others.  
 Description : The project intends to assist Hindustan Steel Ltd., Rourkela in the quality grading of tinplate for fabrication and quality control of tinplate; to set-up an experimental cans fabrication unit in the Institute for conducting pilot plant trials on can fabrication using indigenous tinplate and to assist the canning industry; to replace imported tinplate completely with indigenous tinplate for canning processed food products.  
 Report(s) : -  
 Papers Published : 1. Mahadevaiah, M. and Anandaswamy, B. Development of indigenous packaging materials for processed food products. (Indian Food Packer. 36(1); 1982; 33).
- 115 Project Title : Studies on the suitability of alternatives to tin plate container for packing processed food products.

- Organisation : Central Food Technological Research Institute, Mysore-570013;  
 Packaging Technology Discipline.
- Project Category: : Applied.
- Cost : Rs. 1,68,000/-.
- Duration : June 1979-May 1981.
- Sponsor(s) : Institute,
- Investigator(s) : Ananda Swamy, B. and others.
- Description : Earlier studies were conducted at the institute with Rourkela electrolytic tin plates. The present study is concerned with tin free steel (TFS) (chromium/chromium oxide coated). A few products packed in TFS cans and stored at room temperature (23-30 C) and 37 C were periodically analysed. Anodic stripping method was standardised and used to determine the thickness of chromium in TFS cans and chromium content in the product. Potato and fish stored acceptably in these cans for 9 months, ivy gourd for 6 months (at ambient temperature) and milk powder for 6 months (at ambient temperature and at 37 C). Mango juice could be stored satisfactory upto 6 months in cans with tin plate body and TFS ends. Similar results were obtained with several other products. Corrosion studies showed that when tin plate was coupled with TFS, the coupling potential shifted towards tin plate as a result of which iron exposure in TFS had little effect in increasing its corrosion. Trials were also conducted on the packaging of mango juice/pulp in 2 ply transparent laminate pouches of polyester/polythene, and of mango jam and tomato ketch up in flexible pouches of paper aluminium foil/ LDPE and lacquered aluminium collapsible tubes with satisfactory results.
- Report(s) : Consolidated report.
- Papers Published :
  1. Gowramma, R.V. and others. Preliminary studies on suitability of flexible packaging materials for packing processed food products. Indian Food Packer 35(2); 1981; 55-61.
  2. Mahadevaiah, M. and Gowramma, R.V. Metallic contamination in canned fruit and vegetable products. Indian Food Pack. 34(1); 1980; 35.
  3. Mahadevaiah and others. Chromium coated steel plate as an alternative to tin plate for canning. J. Food Sci. Technol. 34; 1980; 283.
  4. Mahadevaiah, M. and others. Suitability of tin free steel for canning processed food products. Presented at Ahara 82: International Food Conference, Bangalore, May 1982.
  5. Naresh, R. and others. Chromium coated steel plate as an alternative to tinplate for canning food products. J. Fd. Sci. Technol. 17; 1980; 283-286
- 116 Project Title : Screening of food lacquers by physico-chemical and product performance tests.
- Organisation : Central Food Technological Research Institute, Mysore-570013;  
 Packaging Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 2,11,300/-.
- Duration : June 1981-May 1983.
- Sponsor(s) : Institute.
- Investigator(s) : Mahadevaiah, M. and others.
- Description : Methods for determination of thickness of lacquered coating and porosity in lacquered cans were standardised. Studies were carried out to identify different kinds of lacquers and a method using IR spectra in the range of 2.5  $\mu$  to 16  $\mu$  was streamlined. Studies on suitability of various lacquers carried out with various fruits and vegetables (potato, ivy gourd, papaya slices, mango juice, orange juice and concentrate, tomato paste, black grapejuice) showed that polyester based lacquer was suitable for most products as compared with epoxy phenolic and phenolic lacquers.



- Report(s) : -  
Papers Published : -
- 117 Project Title : Lining material for plywood tea chest.  
Organisation : Tea Research Association, Tocklai Experiment Station, Jorhat-785008.  
Project Category : Applied.  
Cost : -  
Duration : 1980-1982.  
Sponsor(s) : Tea Research Association.  
Investigator(s) : Das, A.K.  
Description : Biaxially oriented polypropylene lining in 50 kg plywood tea chest was tested against standard aluminium foil lining. Preliminary findings indicate that polypropylene lining did not impart any taint or cause any adverse effect on the liquor characteristics of made tea. No significant difference was noticeable in the moisture content in the teas packed with polypropylene lining and foil lining. The experiments will be continued for a storage period of one year and the stored tea evaluated organoleptically, biochemically, toxicologically and physicochemically.  
Report(s) : Annual Report.  
Papers Published : -
- 118 Project Title : Long-term trial with newly approved lining material.  
Organisation : Tea Research Association; Tocklai Experiment Station, Jorhat-785008.  
Project Category : Applied.  
Cost : -  
Duration : 1980-1982.  
Sponsor(s) : Tea Research Association.  
Investigator(s) : Das, A.K.  
Description : The lining materials collected randomly from local market and tested were: nitrocellulose film, 12 micron metallised polyester film and aluminium foil lining. Storage tests in plywood tea chests lined with the above materials are being conducted and the evaluation carried out after 18 months of storage.  
Report(s) : Annual Report.  
Papers Published : -
- 119 Project Title : Development of design criteria for the location of aeration holes in corrugated fibreboard boxes.  
Organisation : Central Food Technological Research Institute, Mysore-570013; Packaging Technology Discipline.  
Project Category : Applied.  
Cost : -  
Duration : April 1979-March 1980.  
Sponsor(s) : Institute.  
Investigator(s) : Vijayendra Rao, A.R. and others.  
Description : The compression strength of corrugated fibreboard boxes was studied in statistically designed experiments. Studies indicated the existence of a vulnerable zone in the vertical panels, near the corners and at about 75% distance of the vertical panels from the centre and along the diagonals. Aeration holes located in this zone reduced box compression strength. On the other hand, aeration holes provided around the centre of the panel within a distance of 25% of the centre showed a tendency to increase the box compression strength.  
Report(s) : Final.  
Papers Published : -

- 120 Project Title : Design of optimum corrugated fibreboard boxes and internal fillments for bottled and canned foodstuffs.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Packaging Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 1,18,000/-.
- Duration : June 1980-June 1982.
- Sponsor(s) : Institute.
- Investigator(s) : Veerraju, P. and others.
- Description : The damage of cans was found mainly due to distortion and bowing of top and bottom panels of corrugated fibre boxes (CFB) during drops and methods were therefore developed to prevent the damage. Kraft paper (virgin/recycled) and corrugated fibre board were tested for their strength and corrosive properties. The recycled krafts had about half the strength and one and a half times chloride content of the general Indian Virgin krafts. The virgin non wood fibre krafts have 80 to 90% of the strength and 1.1 Chloride content of the virgin kraft with the high-strengthy materials and a proper design of the box, the denting could be reduced to half as revealed by drop tests. Despite high chloride or sulphate contents, the kraft boards did not induce corrosion. Some of the kraft boards with higher burst factor did not exhibit the corresponding qualities desired for imparting compression strength or flat crush resistance properties to corrugated board boxes.
- Report(s) : -
- Papers Publishes : -
- 121 Project Title : Design and development of containers from wood products.
- Organisations : Forest Research Institute and Colleges, New Forest, Dehradun, Uttar Pradesh-248006.
- Project Category : Applied.
- Cost : Rs. 1.10 lakhs per annum.
- Duration : 1979.
- Sponsor(s) : Govt. of India, Ministry of Agriculture.
- Investigator(s) : Sanyal, S.N. and others.
- Description : The project intends to design containers from certain wood products which could be used in place of conventional containers for fruit packaging in order to meet the problem of timber shortage felt by industries.
- Report(s) : -
- Papers Published : 1. Tandon, R.C. and Singh, J.B. Alternate package for apples (under publication).  
2. Tandon, R.C. and Singh, J.B. Woven veneer box for apples (under publication).  
3. Tandon, R.C. and Saxena, R.C. Use of plywood in corrugated boxes (under publication).  
4. R.C. Tandon. Optimum utilisation of wood and paper for boxes (under publication).
- 122 Project Title : Standardisation of methods for the measurement of grease resistance of packaging papers and correlation of oil penetrating time of different oils through packaging papers.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Packaging Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 21,150/-.
- Duration : April 1979-March 1980.
- Sponsor(s) : Institute.
- Investigator(s) : Veerraju, P. and others.



Description : In studies to develop objective methods to measure the oil exudation time through packaging materials, visual measurements, photo electric reflectance meters, stain detection methods using change in resistance of paper to oil penetration, photo and LDR detectors were not found reliable. However, bridge circuits using LEDs both as light source and light sensitive detectors showed promise for detecting change in brightness due to oil stain on backing paper. The problems due to small temperature variations could be overcome by compensatory circuits to balance the temperature changes. The method is yet to be improved for use as a standard method.

Report(s) : Final.

Papers Published : -

## CHEMICAL TECHNOLOGY

- 123 Project Title : Work on production of sodium silicate from paddy husk ash and associated work on production of hardboard, alternative to cement, etc. all from paddy husk.
- Organisation : Paddy Processing Research Centre, Tiruvarur-610108.
- Project Category : Applied.
- Cost : -
- Duration : 1977-1979.
- Sponsor(s) : Centre.
- Investigator(s) : Subramanyan, V. and others.
- \*99
- 124 Project Title : Production of oxalic acid from saccharine material.
- Organisation : National Sugar Institute, Kanpur, Uttar Pradesh.
- Project Category : Applied
- Cost : -
- Duration : 1976-1980.
- Sponsor(s) : Institute.
- Investigator(s) : Raha, A.C.; Bose, S.
- \*100
- 125 Project Title : Production of citric acid from saccharine materials.
- Organisation : National Sugar Institute, Kanpur, Uttar Pradesh.
- Project Category : Applied.
- Cost : -
- Duration : 1977-1980.
- Sponsor(s) : Institute.
- Investigator(s) : Viswanathan, L; Agrawal, P.K.
- \*102
- 126 Project Title : Immobilization of enzymes.
- Organisation : Nagpur University; Laxminarayan Institute of Technology, Nagpur, Food Technology Section.
- Project Category : Fundamental.
- Cost : -
- Duration : 1976.
- Sponsor(s) : Univeristy.
- Investigator(s) : Rao, B.Y. and others.

Description : Immobilisation of papain on inert supports like activated charcoal and silica gel has been successfully carried out. The applications of the same are being studied. Lipoxidases, lipases and other enzymes isolated from plant and fungal sources are also being immobilized on various supports.

Report(s) :

Papers Published : 1. Vaidya, N.G., Mrs. Shastri, P.N. and RAO, B.Y. Studies on immobilization of papain. Proceedings of the 1st National seminar on immobilized enzymes.

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127 Project Title : Studies on immobilised enzymes with special reference to polyphenoloxidase, tannase (tea) and glucose isomerase.

Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition Discipline.

Project Category : Fundamental and applied.

Cost : Rs. 1,49,600/-.

Duration : April 1980-March 1983.

Sponsor(s) : Institute.

Investigator(s) : Ramakrishna, M. and others.

Description : Polyphenol oxidase from mango peel (*Mangifera indica* var. *Raspuri*) was purified 126 fold to homogeneity with 52% recovery and tested for substrate specificity, effect of inhibitor, isoelectric point, pH and temperature optima, thermostability; storage stability and molecular weight. Glucoamylase and glucose isomerase (whole cells and cell free) were immobilised on supports like collagen, polyacrylamide gel, CN-Br activated Sepharose-6MB, and pH optima of these immobilised enzymes were studied. Attempts were made to prepare enzyme complex of glucose isomerase (cell free) and glucoamylase together on a simple support of CN-Br activated Sepharose-6MB.

Report(s) :

Papers Published : 1. Katwa, L.C. and Raghavendra Rao, M.R. Purification of polyphenoloxidase from mango peel (*Mangifera indica* and *Raspuri*). (Presented at Annual Meeting of the Society of Biological Chemists, India, Baroda, November 1981).

2. Katwa, L.C. and others. Spectrophotometric assay of immobilised tannase. (*J. Biosci.* 3; 1981; 135).

3. Raghavendra Rao, M.R. and others. Studies on immobilised polyphenol oxidase, tannase, glucose isomerase and cells of *Pseudomonas transconititus*. (Present at National Symposium on Biotechnology, Institute of Chemical Biology, Calcutta, December 1981).

128 Project Title : Saccharification of inedible starch by immobilised glucoamylase.

Organisation : Indian Institute of Science, Bangalore- 560 012; Department of Chemical Engineering.

Project Category : Applied.

Cost : Rs. 2,00,000/-.

Duration : 1976-.

Sponsor(s) : Institute.

Investigator(s) : Sastri, N.V.S. and others.

Description : The objectives of the project are: (i) selection of a thermophilic organism capable of yielding active thermostable glucoamylase, (ii) immobilisation of the enzyme on inorganic supports to obtain operationally stable insolubilised enzyme and (iii) use the immobilised enzyme in suitable reactors for the conversion of inedible starch (from seeds) to glucose. Earlier, a systematic screening of various thermophilic microorganisms showed that the species *Thermomyces lanuginosus* elaborated



good yields of highly active thermostable glucoamylase. The enzyme was isolated, purified and characterised chemically and physically. The enzyme was found superior to commercially available mesophilic form in its catalytic properties and stability towards heat and denaturing agents. It was optimally active at pH between 4.8-5.2 and at 60 C. The enzyme was immobilised using various organic supports by adsorption, covalent attachment and gel entrapment techniques. The kinetic properties and operational stability of the immobilised enzyme indicated promise for its application in continuous starch saccharification. Currently, work is in progress on large scale extraction of the thermostable glucoamylase and its immobilisation on inorganic supports like glass and zircon sand which could resist microbial attack. Laboratory scale studies are being conducted to assess kinetic properties and operational stability of the immobilised enzyme. Further work will be to evaluate the various inorganic supports with respect to method of immobilisation and stability, delineation of the operation of an immobilised glucoamylase reactor and design and operation of a pilot plant for the above.

Report(s) : Studies on starch conversion to glucose using native and immobilised glucoamylases - Ph.D. thesis submitted by V.B. Rao in January 1981.

Papers Published : 1. 'Physical and chemical characteristics of free vs immobilized enzymes', Paper published in Proceedings of the First National Seminar on Immobilized Enzyme Engineering held at the Jadavpur University, Calcutta, March 24-26, 1979.  
 2. V.B. Rao and others. A thermostable glucoamylase from the thermophilic fungus T. Lanuginosus. Current Science, 48, 1979; 113  
 3. N.V.S. Sastri and K.V. Deshpande. 'The effect of chemical inhibition on diffusion coupled enzyme reactions in a tubular immobilized enzyme reactor' (Under communication).  
 4. N.V.S. Sastri. 'Laminar flow tubular enzyme reactor for the kinetic characterization of immobilized enzymes'. Published in the Proceedings of the First National Seminar on Immobilized Enzyme Engineering held at the Jadavpur University, Calcutta, March 24-26, 1979.  
 5. Basaveswara Rao, V., and others. 'Purification and characterization of glucoamylase from the thermophilic fungus T. Lanuginosus' (Biochemical Journal, 193, 1981; 376  
 6. Basaveswara Rao, V., and others. 'Thermal stabilization of glucose oxidase and glucoamylase by physical entrapment'. Biochemical Journal. 193, 1981; 379

129 Project Title : Production of pectolytic enzyme from regional fruit industry wastes.  
 Organisation : Regional Research Laboratory, Canal Road, Jammu Tawi-180001.  
 Project Category : Applied.  
 Cost : Rs. 62,500/-.  
 Duration : July 1976-December 1982.  
 Sponsor(s) : Council of Scientific and Industrial Research.  
 Investigator(s) : Bhatia, A.K.; and others.  
 Description : The possibility of utilization of waste apple pomace for the production of pectolytic enzymes, is being explored. A strain of Aspergillus niger has given satisfactory yields of the enzyme by surface fermentation. The process of liquefaction of various fruits by enzyme preparation is under trial and will be scaled upto pilot plant level.

Report(s) : -  
 Papers Published : -  
 \*120

130 Project Title : Utilisation of pure pectic enzyme  
 Organisation : Government Fruit Preservation and Canning Institute,  
 18-B, Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981/82-1982/83.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Surjeet Singh; and Tripathi, V.K.  
 Description : These studies are concerned with the efficiency of pure pectic  
 enzyme in relation to juice extraction from fruits like banana,  
 guava, apples, etc. Efforts will also be made to increase the  
 efficiency of the enzyme by addition of some activators.  
 Report(s) : Interim  
 Papers Published : -

#### Pectins

131 Project Title : Pectic enzymes.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B,  
 Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : March 1981-March 1983  
 Sponsor(s) : Government of Uttar Pradesh  
 Investigator(s) : Revis, B; and others.  
 Description : A standard media was supplemented with citrus pectin and a  
 considerable increase in the activity of pectic enzymes was  
 noticed. Apple and guava pectins will also be tried to study  
 their effect on the production of pectic enzymes.  
 Report(s) : -  
 Papers Published : -

132 Project Title : Studies on correlation of different units of activities of var-  
 ious grades of papain.  
 Organisation : Central Food Technological Research Institute - Experiment  
 Station, Hyderabad.  
 Project Category : Applied.  
 Cost : Rs. 23,700/-.  
 Duration : Aug.1979-Jan.1981  
 Sponsor(s) : Institute.  
 Investigator(s) : Krishna Murthy, G.V. and others.  
 Description : Three grades of papain (papain B.P.C., Papain I.P. and pure  
 papain concentrate) were prepared from crude papain (dried  
 papaya latex) and tested for proteolytic activities by differ-  
 ent assay methods, viz. B.P.C., I.P., milk clotting and National  
 Formulary (NF) methods. The values obtained by different me-  
 thods were correlated with each other. Data regarding yields of  
 the above papain grades and storage stability of purified papain  
 were obtained.  
 Report(s) : Final.  
 Papers Published : -

133 Project Title : Utilization of cellulose for food energy.  
 Organisation : National Chemical Laboratory, Pune 411008.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 75,42,200/-. (CSIR funds)  
 Duration : For CSIR, 1974 onwards, For UNDP 1981 onwards.  
 Sponsor(s) : CSIR/UNDP.



- Investigator(s) : Doraiswamy, L.K.; and others.
- Description : The project is planned to develop a simple fermentation process for the production of microbial biomass product from cellulose; to develop a process for the enzymic hydrolysis of cellulose to glucose; to produce cellulolytic enzymes by screening for new and better strains of cellulolytic microorganisms and their mutants which are capable of digesting cellulosic materials for production of glucose and the utilization of glucose by yeast for alcohol production; and to isolate and characterize the components of the cellulose complex of promising cellulolytic organisms..
- Report(s) : -
- Papers Published
1. Bastawade, K.B. and others. Cellulolytic enzymes of a penicillium strain. Proceedings of the Symposium on Bioconversion, Indian Institute of Technology, New Delhi, 1977; 143
  2. Bastawade, K.B. and others. Enzyme hydrolysis of cellulose. Proceedings of the Symposium on bioconversion, Indian Institute of Technology, New Delhi, 1977; 387.
  3. Bendale, D.S. Reactivity of dissolving pulp in viscose rayon manufacture. Handbook of Rayon, Century Rayon Publication, 1971.
  4. Bendale, D.S. and Khadilkar, H.P. Improved method of purification of cotton linters. Indian Pulp and Paper. 1968 (January).
  5. Deshpande, V.S. and others. Single cell protein from cellulosic materials. Proceedings of the Industrial Fermentation Symposium, Regional Research Laboratory, Jammu, 119; 1978.
  6. Deshpande, V.V. and others. Utilisation of cellulosic waste for energy production. Reg. Journal of Energy heat Mass Transfer. 2; 1980; 23.
  7. Lakshmikantham, B.C. Purification and properties of glucosidase of Penicillium funiculosum. Paper presented at the II International Symposium on Bioconversion and Biochemical Engineering, Indian Institute of Technology, New Delhi. 1980.
  8. Sadana, J.C. and others. Biochemistry of cellulose degradation and cellulose utilisation for feeds and for protein. Journal of Scientific and Industrial Research. 38; 1979; 442.
  9. Sadana, J.C. and others. Enhanced cellulase production by a mutant of Sclerotium rolfsii. Applied Environmental Microbiology. 38(4); 1979; 730.
  10. Sadana, J.C. and others. High cellobiase and xylanase production by S. rolfsii UV-8 mutant in submerged culture. Applied Environmental Microbiology. 38(4); 1979; 935
  11. Sadana, J.C. and others. Enzymatic hydrolysis of cellulosic materials by S. rolfsii UV-8 mutant culture filtrate. Proceedings of the II International Symposium on Bioconversion and Biochemical Engineering, Indian Institute of Technology, New Delhi, 1980.

12. Shewale, J.G. and Sadana, J.C. Enzymatic hydrolysis of cellulosic materials by *S. rolfsii* culture filtrate for sugar production. Canadian Journal of Microbiology. 25; 1979; 773.
13. Shewale, J.G. and Sadana, J.C. Cellulase and  $\alpha$ -glucosidase production by a basidiomycete sp. Canadian Journal of Microbiology. 24; 1978; 1204.
14. M.C. Srinivasan. Cellulose, a source of single cell protein production. Chemical Industry Development. 11; 1977; 26.
15. Srinivasan, M.C. and others. Utilisation of cellulose for the production of glucose and single cell proteins. Hindustan Antibiotics Bulletin. 19; 1977; 31.
16. Srinivasan, M.C. and Jagannathan, V. Utilisation of cellulose by fermentation. Proceedings of the Symposium on perspectives in Industrial Microbiology. 30; 1977;
17. Vaidya, M. and others. Purification and properties of endo- and exo-glucanase of *Fusarium lini*. Paper presented at the II International Symposium on Bioconversion and Biochemical Engineering, Indian Institute of Technology, New Delhi, 1980.
18. Report of testing for dissolving pulp from a mixture of hardwoods of Central Zone by NCL. Forest Survey Bulletin, 10; 1969; 68.

- 134 Project Title : Cellulase enzyme.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : April 1980-March 1982  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Revis, B.; and others.  
 Description : Cellulase enzyme has been prepared by growing *Trichoderma viridae* on wheat bran media and the enzyme is being tried for extraction of ginger juice. Use of the enzyme on extraction of juice from other fibrous materials like pineapple will also be studied.  
 Report(s) : -  
 Papers Published : -
- 135 Project Title : Strain selection and improvement of microorganism for the production of glucose isomerase, xylanase, xylose, reductase and amylolytic enzymes.  
 Organisation : Central Food Technological Research Institute; Microbiology, Fermentation and Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 2,50,350/-.  
 Duration : April 1977-March 1980.  
 Sponsor(s) : CSIR  
 Investigator(s) : Richard Joseph; Nirmala Devi.  
 Description : Glucose isomerase production in *Streptomyces fradiae*, conditions for stimulating enzyme production by  $\text{CaCl}_2$  without toxic effect, reversal of toxicity by some mineral salts and the effect of some amino acids on the retardation of growth inhibition were studied. The conditions for obtaining thermal stability were elucidated. A hybrid culture of the organism possessing



xylanase was grown on wheat bran and it produced glucose isomerase without added glucose. Some UV induced variant of *Aspergillus terreus* and *Neurospora crassa* produced enhanced xylanase levels. The differences in the two systems were studied. The two enzymes functioned synergistically when present together. Fungal xylanase could be used for oil extractions from orange and lime peels and this could be monitored by gas chromatographic estimation of limonene in extracted material.

- Report(s) : Final.
- Papers Published : 1. Harish, V. and Richard Joseph. Xylanase production by ultra-violet ray induced mutants of *Streptomyces fradiae* SCF-S. Presented at First Indian Convention of Food Scientists and Technologists, Mysore, June 1978 .
2. Krishna Nand and others. Production of glucose isomerase by *Streptomyces fradiae*. Indian J. Exp. Biol. 15; 1977; 668 .
3. Nirmala Devi and Richard Joseph. Induction and purification of glucose isomerase from *S. fradiae* SCF-5. Presented at Annual Conference of Association of Microbiologists of India, Hissar, November 1979 .
4. Richard Joseph and others. Isolation of *Streptomyces* having high glucose isomerase activity and assessment of their efficiency in the production of fructose syrups. J. Food Sci. Technol. 14; 1977; 73 .
5. Sharma, A. and Richard Joseph. Some preliminary studies on fungal xylanases Presented at Annual Conference of Microbiologists (India), December 1977 .
6. Sharma, A. and Richard Joseph. Purification and properties of xylan hydrolases from *Monilla* sp. Presented at Annual Conference of Association of Microbiologists of India, Hissar, November 1979 .
7. Sreenath, H.K. and Richard Joseph. Purification and properties of xylan hydrolases of *S. exfoliatus* MC-1 Presented at Annual Meeting of Biological Chemists (India), Lucknow, October 1979 .
8. Sreenath, H.K. and others. Studies on xylanases from different *Streptomyces* isolates and their mutual influence on the breakdown of xylan. Folia Microb. 23; 1978; 301 .

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- 136 Project Title : Studies on lipolytic enzyme from yeasts and molds.
- Organisation : National Dairy Research Institute, Karnal-132 001; Dairy Bacteriology Division.
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : ICAR
- Investigator(s) : Harish Chander; and others.
- Description : The crude enzymes were partially purified by fractional precipitation with ammonium sulphate and it had 12 times more specific activity than crude enzyme and showed a recovery of 89%. The lipase activity increased with the concentrations of the enzyme in the mixture and decreased with temperature (the maximum activity being at 37 C and pH 6.0).
- Report(s) : Annual.
- Papers Published : 1. Chopra and others. Factors affecting lipase production in *Mucor-racemosus*. J. Food Prot. 44; 1981; 661 .
2. Chopra, A.K. and others. Lipolytic activity by *Synepholastrum racemosum*. J. Dairy Sci. 65; 1982; 1890

3. Harish Chander and Klostermeyer, H. Factors affecting lipase production in *Mucor mucedo*. Zentralblatt Bakteriell Mikrobiol Hygiene, 3; 1982; 427.
4. Harish Chander and Klostermeyer, H. Production of lipase by *Penicillium funiculosum* under various growth conditions. Arch. Lebens. Hygiene. 33; 1982; 42.
5. Harish Chander and others. Factors affecting lipase production in *Aspergillus-ventii*. J. Food Sci. 45; 1981; 598.
6. Harish Chander and others. Factors affecting lipase production in *Rhizopus nigricans*. (J. Dairy Sci. 64; 1981; 193).
7. Harish Chander and others. Role of lipids on growth and lipase production by *Rhizopus-Stolonifer*. J. Food Prot. 44; 1981; 353.

- 137 Project Title : Studies on the application of microbial enzymes like amylases, proteases and glucose isomerase and preliminary investigations on some ring cleaving enzymes useful in food processing.
- Organisation : Central Food Technological Research Institute, Mysore.
- Project Category : Applied.
- Cost : Rs. 3,33,200/-.
- Duration : April 1978-March 1980.
- Sponsor(s) : CSIR
- Investigator(s) : Sreekantiah, K.R.; and others.
- Description : The enzymes were purified and studied for kinetic properties. They could be used for modification of starches and in the enzymic production of liquid fruit.
- Report(s) : Final.
- Papers Published ;
1. Jaleel, S.A. and others. Efficacy of fungal pectic enzyme in the process of curing coffee. Presented at Second Indian Convention of Food Scientists and Technologists, Mysore, February 1981.
  2. Nalini Ramachandran and others. Studies on thermophilic amylolytic enzymes of a strain of *A. niger*. Die Starke. 30; 1978; 272.
  3. Nalini Ramachandran and others. Influence of media composition on the production of alpha amylase and amyloglucosidase by a strain of *A. niger*. Die Starke 31; 1979; 134.
  4. Ramasesh, N. and others. Purification and characterisation of thermophilic  $\alpha$ -amylase of *Aspergillus niger* van Tieghm. Die Starke, 34(8); 1982; 274.
  5. Ramasesh, N. and others. Studies on the two forms of amyloglucoside of *Aspergillus niger* Van Tieghm. Die Starke. 34(10); 1982; 346.
  6. Venkataramu (K) and others. Glucoamylases of *Aspergillus niger* NRRL 330 Indian J. Biophys. Biochem. 12; 1975; 107.
- 138 Project Title : Processing of foodgrains by microbial enzymes.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Microbiology and Fermentation Technology Discipline.
- Project Category : Fundamental.
- Cost : Rs. 1,74,800/-.
- Duration : June 1982-May 1983
- Sponsor(s) : Institute.
- Investigator(s) : Krishna Nand; and others.
- Description : The project has attempted screening of bacterial and fungal isolates for the production of enzymes to be used for softening of pulses and enzymic treatment of pulses that are hard to cook with different enzyme preparations studies on the quantitative, organoleptic and chemical changes after processing and the



usefulness of such enzymes in releasing the oil from rice bran or other essential oil bearing materials are also being studied.

Report(s) : -  
Papers Published : -

- 139 Project Title : Basic studies on enzymes in relation to food.  
 Organisation : Central Food Technological Research Institute, Mysore-570013, Biochemistry and Applied Nutrition Discipline.  
 Project Category : Fundamental.  
 Cost : Rs. 1,10,000/-.  
 Duration : Jan.1975-March 1979.  
 Sponsor(s) : CSIR  
 Investigator(s) : Manjunath, P; and others.  
 Description : Purified glucoamylases I and II of *Aspergillus niger* were studied for relationships between them by using rabbit antisera in immunodiffusion and immunoinhibition experiments. Both forms of the enzyme gave a single continuous precipitating band when placed in adjustment walls demonstrating very close structural resemblance. They gave almost identical immunoinhibition patterns and had the same equivalence point indicating that the two forms were immunologically identical. Periodate-treated enzyme as immunologically identical with controls had slightly less enzyme activity but showed greatly reduced stability on storage at 4 C.
- Report(s) : Final.  
 Papers Published : 1. Manjunath, P. and Raghavendra Rao, M.R. Comparative immunochemical studies on fungal glucoamylases. Indian J. Biochem. Biophys. 17; 1980; 388).  
 2. Manjunath, P. and Raghavendra Rao, M.R. Comparative studies on glucoamylases from three fungal sources. J. Biosci. 1; 1979; 409 .  
 3. Manjunath, P. and Raghavendra Rao, M.R. Immunochemical relationships between glucoamylases I and II of *A. niger*. J. Biosci. 2; 1980; 163  
 4. Manjunath, P. and Raghavendra Rao, M.R. Immunological relations among glucoamylases of fungal origin. Presented at Annual Meeting of Society of Biological Chemists (India), Bangalore, 1980 .  
 5. Manjunath, P. and Raghavendra Rao, M.R. Studies on carbohydrate moieties of *Aspergillus niger* glucoamylase II: Isolation, purification and characterisation. J. Biosci. 3; 1981; 333).  
 6. Manjunath, P. Studies on glucoamylases. Ph.D. Thesis. University of Mysore, 1978.  
 7. Venkataramu, K. and others. Glucoamylases of *Aspergillus niger* NRRL 330. Indian J Biochem. Biophys. 12; 1975; 107).

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- 140 Project Title : Studies on regulatory enzymes involved in the biosynthesis of lysine in *Micrococcus glutamicus* and in plant tissues.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition Discipline.  
 Project Category : Fundamental.  
 Cost : Rs. 2,18,500/-.  
 Duration : Jan.1975-April 1980.  
 Sponsor(s) : CSIR  
 Investigator(s) : Meena Lakshman and others.  
 Description : Regulatory properties of aspartokinase, dihydrodipicolinate synthetase and diaminopimelate decarboxylase of *M. glutamicus*

were studied in crude, partially purified (aspartokinase) and homogeneous (diaminopimelate carboxylase) preparations. Comparison of the properties of these enzymes in lysine producing mutant strain and the parent strain from which it was derived indicated that altered sensitivity of aspartokinase to feed back inhibitors provides one plausible reason for lysine over-synthesis by the mutant. The mutant was found to excrete lysine against a concentration gradient. In studies on biosynthesis of aspartate family of amino acids in legumes, oilseeds and cereals, (U-<sup>14</sup>C) aspartic acid was applied to excised stem tips 4-10 day old seedlings and the seedlings were allowed to metabolise it for 6-7 hours. Free amino acids were examined for radio activity. In groundnut and soy bean, the only amino acid which derived label to a significant extent was asparagine and in sesame and paddy, it was glutamate. In ragi, black gram and green gram, the only amino acid other than unutilised aspartate that was labelled was threonine/homoserine. Lysine biosynthesis could not be detected under the conditions of the experiment.

Report(s) : Annual.

- Papers Published :
1. Meena Lakshman and others. Purification and properties of diaminopimelate decarboxylase of *Micrococcus glutamicus*. J. Biosci. 3; 1981; 105.
  2. Meena Lakshman and others. Purification and properties of mesodiaminopropionate decarboxylase of *Micrococcus glutamicus* ATCC 13059. Presented at Annual Meeting of Biological Chemists (India), Lucknow, October 1979 .
  3. Meena Lakshman and Raghavendra Rao, M.R. Latency of methionine repressible NAD-dependent homoserine dehydrogenase of *Serratia marcescens*. Indian J. Biochem. Biophys. 13; 1976; 213 .
  4. Meena Lakshman. Studies on the biosynthesis of the aspartate family of amino acids in bacteria. Ph.D. theses, University of Mysore, 1980.
  5. Shenoy, B.C. and Raghavendra Rao, M.R. Studies on lysine fermentation of *Micrococcus glutamicus*. Present at Annual Meeting of Society of Biological Chemists (India), Bangalore, December 1980 .

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- 141 Project Title : Studies on immobilised enzymes with special reference to the conversion of transaconitic acid to citric acid and immobilisation of polyphenol oxidases.
- Organisation : Central Food Technological Research Institute, Mysore; Microbiology and Fermentation Technology Discipline.
- Project Category : Fundamental and applied.
- Cost : Rs. 77,000/-.
- Duration : Dec.1977-March 1980.
- Sponsor(s) : CSIR
- Investigator(s) : Ramakrishna, M; Susheela, T.
- Description : Immobilised cells of *Pseudomonas transaconititus* were capable of oxidising transeconitate, ciraconitate and citrate and had fumarase and succinic dehydrogenase activities. The viability test showed that the immobilised cells were active and viable. It was indicated that the disappearance of transaconitic acid when incubated with immobilised cells was due to induction of aconitate isomerase and the oxidation of aconitate via citric acid cycle. Studies were also conducted on the immobilisation of polyphenol oxidase from tea leaves, mango peel and crystalline



tannase using 7 different inert supports. DEAE-Sephadex bound PPO from mango peel and polyacrylamide (PAG) entrapped tannase were stable and fully active for 6 months. The properties of the enzymes were also studied. The pPAG entrapped tannase could be used in the production of soluble tea.

Report(s) : Final  
 Papers Published : 1. Ramakrishna, M. and Raghavendra Rao, M.R. Studies on the oxidation of transaconitic acid by immobilised cells of *Pseudomonas transaconititus*. Presented National Seminar on Immobilised Enzymes Engineering, Calcutta, March 1980  
 2. Raghavendra Rao, M. and others. Studies on immobilised polyphenol oxidase, tannase, glucose isomerase and cells of *Pseudomonas transconititus*. Presented at National Symposium on Biotechnology, Institute of Chemical Biology, Calcutta, December 1981 .

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142 Project Title : Fat soluble vitamins A and K: Cell membrane constituents.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition Discipline.  
 Project Category : Fundamental.  
 Cost : Rs. 2,11,650/-.  
 Duration : September 1973-March 1979.  
 Sponsor(s) : CSIR  
 Investigator(s) : Rama Rao, P.B.; and others.  
 Description : Earlier, it was found that in vitamin A deficient rats the glycoprotein profile of erythrocyte membrane was altered. It was also found that adenosine deaminase activities of kidney and lung were reduced indicating possible special effects of retinol deficiency and adenosine metabolism. Incorporation of palmitic acid with membrane lipids and acetate into cholesterol increased osmotic fragility of erythrocytes in vitamin A deficiency rats but not in rats fed excessive vitamin A. Fatty acid profile of the erythrocyte membrane, was, however, not altered. It was suggested that vitamin A deficiency influences processes included in the incorporation of the fatty acid at the site of erythrocyte formation and/or in the exchange of the lipid component between plasma and the erythrocytes. It was further suggested that the equilibrium transfer of retinol of erythrocytes with that of the metabolites in the plasma was a possibility.

Report(s) : Final.  
 Papers Published : 1. Bhat, P.V. and Rama Rao, P.B. Vitamin A nutrition in relation to gangliosides and myelination in the developing brain World Rev. Nutr. Dietet. 31; 1978; 100 .  
 2. Krishnakanth, T.P. and Rama Rao, P.B. Erythrocyte membrane proteins in vitamin A deficiency. Presented at Int. Symposium on Cell Differentiation and Proliferation, Madras, February 1980  
 3. Krishnakanth, T.P. and others. Studies on erythrocytes in retinol deficiency: Erythrocyte membrane proteins and anion (sulphate) permeability. Nutr. Rep. Int. 24(5); 1981; 901 .  
 4. Krishnakanth, TP. and Rama Rao, P.B. Studies on electrophoretic mobility of rat erythrocytes in retinol deficiency. Presented at Annual Meeting of Society of Biological Chemists (India), Baroda, November 1981  
 5. Latif, K.A. and Rama Rao, P.B. Effect of vitamin A deficiency on the subcellular distribution of arylsulphates A

- and B in leucocytes: Presented at Annual Meeting of Society of Biological Chemists (India), Madras, September 1977
6. Latif, K.A. and others. Studies on leucocyte arylsulphatases and mucopolysaccharides in relation to vitamin A nutrition. Nutr. Rep. Int. 24; 1981; 81 .
  7. Latif, K.A. and others. Urinary excretion of arylsulphatases in malnourished vitamin A deficient children. (Clinica Chim Acta, 96; 1979; 131 .
  8. Leela Srinivas and Rama Rao, P.B. Passive efflux of sulphate ( $^{35}\text{SO}_4$ ) from erythrocytes from Vitamin A deficient rats. Presented at Annual Meeting of Society of Biological Chemists (India), Madras, September 1977 .
  9. Leela Srinivas and Rama Rao, P.B. Studies on urine arylsulphatase activity in vitamin A deficient rats. Int. J. Vitamin Nutr. Res. 46(1); 1976; 3 .
  10. Ponnappa, B.C. Studies on erythrocyte membrane: Effect of vitamin A on incorporation of Na acetate- $1\text{-}^{14}\text{C}$  and palmitic acid- $1\text{-}^{14}\text{C}$  into erythrocyte lipids. Presented at Annual Meeting of Society of Biological Chemists, 1973 .
  11. Ponnappa, B.C. and Rama Rao, P.B. Studies on rat erythrocyte membrane: Effect of hypo and hyper vitaminosis A. (Presented at International Symposium on Biomembranes, Madurai, 1973).

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| 143 | Project Title    | : | Studies on the application of Streptomyces glucose isomerase.  |
|     | Organisation     | : | Central Food Technological Research Institute, Mysore-570013; Microbiology and Fermentation Technology Discipline.   |
|     | Project Category | : | Applied.   |
|     | Cost             | : | Rs. 2,37,000/-.  |
|     | Duration         | : | April 1980-March 1982.   |
|     | Sponsor(s)       | : | Institute.   |
|     | Investigator(s)  | : | Richard Joseph and others.   |
|     | Description      | : | Preliminary studies indicated the possibility of simultaneous cultivation of <i>S. fradiae</i> (SCF-5) and immobilisation of glucose isomerase. Tapioca hydrolysate was isomerised using <i>S. fradiae</i> cells (not immobilised) to produce high fructose syrup (having equal proportions of fructose and glucose) which was again refined using active carbon and ion exchangers. <i>S. fradiae</i> also produced an extracellular amylase which may find use for processing starchy substrates. A hybrid Streptomyces (FE-16) having both xylan hydrolase and glucose isomerase producing traits produced the isomerase without cobalt in the cultivation medium unlike the SCF-5 culture. |
|     | Report(s)        | : | -  |
|     | Papers Published | : | -  |
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| 144 | Project Title    | : | Scale up studies on manufacture of glucose isomerase by submerged fermentation.   |
|     | Organisation     | : | Central Food Technological Research Institute, Mysore-570013; Microbiology and Fermentation Technology Discipline.  |
|     | Project Category | : | Applied.  |
|     | Cost             | : | Rs. 2,42,000/-.   |
|     | Duration         | : | June 1981-May 1983  |
|     | Sponsor(s)       | : | Institute.  |
|     | Investigator(s)  | : | Joseph, R, and others.  |
|     | Description      | : | Optimal conditions for the production of glucose isomerase by Streptomyces fradiae SCF-5 were determined in a 10 litre fermentor. Data generated included those as aeration rate, agitation speed and pH of the broth. The optimum concentration of |



xylose required in the fermentation medium when cottonseed hull hydrolysate was used as the source of xylose was also determined. Under optimum conditions the period of fermentation was reduced to 30 hours from 48 hours taken in shake flasks. The yield of dry biomass was 5-6 mg/ml and 1-9 enzyme units/ml of the fermentation broth. In trials in various capacity fermentors, it was found that the variations in biomass and enzyme fibres was due to inhibition of cell growth and enzyme formation in medium cottonseed hull hydrolysate on source of xylose. Replacement of starch with glucose and cottonseed hydrolysate with xylose improved enzyme fibre and growth in shake flask. The immobilisation of the enzyme (cell bound) was done by heat fixing, providing protectants, and working out the glutaraldehyde concentration. It was found that the cells exposed to 60 C with glucose or xylose and metallic cofactors (Mg and Co) as protectants and using glutaraldehyde at 2.5% level retained maximum activity.

Report(s) : Interim report.

Papers Published ; 1. Lonsane, B.K., Ghildyal, N.P. and Sreenivasa Murthy, V. Solid state fermentation processes and their challenges. Paper presented at the Symposia on fermented foods, food contaminants, biofertilizers and bioenergy, AMI, Mysore, November 1982.

145 Project Title : Studies on food enzymes with special reference to those used for the preparation of instant tea (polyphenoloxidase and tannase) and high fructose syrups (Glucoamylases,  $\alpha$ -amylase and glucose isomerase) including their immobilization studies.

Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition Discipline.

Project Category : Applied.

Cost : Rs. 4,10,000/-.

Duration : April 1982-July 1984.

Sponsor(s) : Institute.

Investigator(s) : Raghavendra Rao, M.R. and others.

Description : Two enzymes (glucoamylase from *Rhizopus* species and glucose isomerase from *Streptomyces fradiae*) and three enzymes (the above two with  $\alpha$ -amylase from *Bacillus subtilis*) and also individual enzymes were co-immobilised on CNBr activated Sephadose 6MB. Some of the parameters such as pH and temperature activity relationship of the immobilized enzymes and multienzyme systems were studied. Glucoamylase from *Rhizopus* species was purified to homogeneity by conventional protein purification techniques like gel chromatography and ion-exchange chromatography.

Report(s) : -

Papers Published : -

146 Project Title : Scale-up studies on fungal protease (microbial rennet) by solid state fermentation and its modifications for use in cheese making.

Organisation : Central Food Technological Research Institute Mysore-570013; Microbiology and Fermentation Technology Discipline.

Project Category : Applied.

Cost : Rs. 75,000/-.

Duration : June 1981-May 1982.

Sponsor(s) : Institute.

Investigator(s) : Krishna Nand and others.

Description : Process protease production from *Rhizopus oligosporus*, developed earlier was scaled up to 5 litre level under solid-substrate

conditions. Various fermentation criteria such as substrate concentration, moisture level, trace metal concentrations, incubation period, pH, size and age of inoculum and tray load were determined. Using these optimised parameters, an enhanced yield of the enzyme in the range of 2000-3000 SU per gram of dry mouldy bran in 36 hours was obtained repeatedly with 100 kg substrate broth. Conditions for precipitation and concentration of the enzyme with acetone were determined. Various parameters affecting separation of the protease in a 16 litre column were optimised using an indigenous resin (Indian 286 VC) substituting for Amberlite-IRC 50. Cheddar cheese trials were carried out with 500 litres of cow's milk per batch. The cheese so prepared compared favourably with that made with animal rennet. A dry mix has also been developed to prepare mildly acid curd with smooth and hard set, good texture and flavour within one hour. The dry mix can be preserved for about 3 months in aluminium laminated films.

Report(s) : -  
Papers Published : -

- 147 Project Title : Enzymic hydrolysis of lignocellulosic wastes and their utilisation in fermentation feed stock.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Microbiology and Fermentation Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 14,10,000/-.
- Duration : April 1980-March 1983.
- Sponsor(s) : Institute.
- Investigator(s) : Sreekantiah, K.R. and others.
- Description : The project is concerned with (i) characterisation of fungal and bacterial proteases and evaluation of their industrial applications, (ii) utilisation of amylolytic microorganisms for saccharification, of starchy substances and fermentation to ethanol and (iii) identification and selection of cellulolytic microorganisms and development of optimum conditions for producing cellulosaccharides. The work carried out so far includes: Screening of various strains of fungi and bacteria for cellulolytic activity and production of enzymes by them. Cellulase production on spent wheat bran, effect of various carbon and nitrogen sources on enzyme production by *Penicillium* strain, organic acid production by cellulolytic fungal use of tapioca starch residue as fermentation substrate use of molasses as substrate for dextran production and industrial use of microbial protease as for example degumming silk waste. The studies are continuing.
- Report(s) : Consolidated Report.
- Papers Published : 1. Ghildyal, N.P. and others. Studies on the production of  $\alpha$ -amylase in submerged culture. J. Fd. Sci. Tech. 17(4); 1980; 165
2. Jaleel, S.A. and others. Use of fungal pectic enzyme in the production of tamarind concentrate. Indian Fd. Pckr. 34(5); 1980; 12
3. Manonmani, H.K. and others. Development of  $\alpha$ -amylase production medium by utilizing agricultural wastes. J. Fd. Sci. Technol. 20(4); 1983; 168
4. Manonmani, H.K. and Sreekantiah, K.R. Pigment production by a strain of *Aspergillus oryzae* var. *effusus*. Indian J. Microbiol. 1983.
5. Nalini Ramesh and others. Purification and characterization of thermophilic  $\alpha$ -amylase of *Aspergillus niger* var. Tieghm. Die Starke 34(10); 1982; 274,.



6. Nalini Ramesh, and others. Studies on the two forms of amyloglucosidase of *Aspergillus niger* van Tieghm. Die Starke 34(10); 1982; 346 .
7. Prema, P. and Sreekantiah, K.R. Dextran production by fermentation. Paper presented at the 23rd Annual Conference. of AMI, CFTRI, Mysore, Nov.21-23, 1982.
8. Sreekantiah, K.R. Alternative substrates for ethanol fermentation: possibility of utilizing starchy material and starch factory wastes. Paper presented at the Colloquium on Power alcohol production, CFTRI, Mysore, April 1, 1982.
9. Sreekantiah, K.R. and others. Studies on the extraction of pectinases from mouldy bran. Indian Fd. Packr.34(2); 1980; 17
10. Sreekantiah, K.R. and Satyanarayana Rao, B.A. Production of ethyl alcohol from tubers. J. Fd. Sci. Technol. 17(5); 1980; 194
11. Theja, K. and others. Microbial degradation of cellulosic materials isolation and screening of fungi. J. Fd. Sci. Technol. 20(2); 1983; 168

148 Project Title : Scale-up studies on the production of amyloglucosidase by surface fermentation.

Organisation : Central Food Technological Research Institute, Mysore-570013; Microbiology and Fermentation Technology Discipline.

Project Category : Applied.

Cost : Rs. 50,250/-.

Duration : August 1978-February 1980.

Sponsor(s) : Institute.

Investigator(s) : Lonsane, B.K. and others.

Description : Several batches of different quantities of wheat bran per batch were studied for various parameters like preparation of starch for inoculation of commercial batch, fermentation timing, heat generation, extraction and precipitation of the enzyme by using various solvents. The enzyme obtained during these experiments were supplied to the industry. Scale up studies on the enzyme production by solid-state fermentation were completed and the process made ready for commercial exploitation Cost estimates for a plant of 10,000 litres of enzyme concentrate per year and cost of production were also worked out.

Report(s) : -

Papers Published : -

149 Project Title : Scale-up studies on production of  $\alpha$ -amylase by surface fermentation.

Organisation : Central Food Technological Research Institute, Mysore-570013; Microbiology and Fermentation Technology Discipline.

Project Category : Applied.

Cost : Rs. 74,500/-.

Duration : January 1979-May 1981

Sponsor(s) : Institute.

Investigator(s) : Gildyal, N.P. and others.

Description : Fermentation parameters needed for the scale up of  $\alpha$ -amylase production by *Aspergillus niger* were optimised at pilot level. Based on the pilot scale trials, the data were scaled up for a plant of 20,000 litre capacity of  $\alpha$ -amylase concentrate (3000 units/ml) per annum. The cost of production was worked out. The enzyme could also be produced in crude powder form.

Report(s) : -

Papers Published : 1. Ghildyal, N.P. and others. Studies on the production of alpha-amylase in submerged culture. J. Food Sci. Technol. 17(4); 1980; 139

- 150 Project Title : Microbial production of gibberellic acid.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Microbiology and Fermentation Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 2,23,600/-.  
 Duration : June 1979-May 1982  
 Sponsor(s) : Institute.  
 Investigator(s) : Ramakrishna, S.V. and others.  
 Description : Of the several strains of Giberilla fujikuroi, Fusarium moni-  
liforme and Urediploia theobromae tried G. fujikuroi M,  
 strain gave maximum yield and was selected for further studies. Nine different media were evaluated and the basal medium identified as the best was further test for optimising the requirements of nutrients and efficiency of precursors to increase the yield of gibberellic acid. Under solid state fermentation conditions, G. fujikuroi SV-1 and B. theobromae MS-8 strains showed promise. Three different carbon sources, either separately or in combination, were evaluated for gibberellic acid production. The requirements of inorganic elements, optimum pH, buffering of the medium and inoculum were optimised. In studies on the extraction of gibberellic acid from moldy bran, 80-90% of the acid could be extracted under optimum conditions. Purification steps were streamlined to obtain a colourless product. In bioassays of gibberellic acid conducted by using various seeds, that with dwarf rice gave good correlation between plant growth and increase in amylolytic activity though the system often got contaminated with microorganisms. Solid state substrates showed good growth of microorganisms, but acid yields even under identical culture conditions showed variations, the reasons for which are to be identified. Spectrophotometry, colorimetry, fluorometry, thin layer chromatography and high pressure liquid chromatography were used to confirm the presence of gibberellic acid in the culture filtrates.  
 Report(s) : -  
 Papers Published : 1. Ramakrishna, S.V. and others. Microbial production of gibberellic acid - a Status Report. Present at All India Seminar on Biotechnological Processes in Industry, Calcutta, November 1979 .
- 151 Project Title : Preparation and evaluation of sucrose glycerides.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Experiment Station, Hyderabad.  
 Project Category : Applied.  
 Cost : Rs. 1,07,000/-.  
 Duration : August 1979-July 1981  
 Sponsor(s) : Institute.  
 Investigator(s) : Venkateswara Rao, M.; Giridhar, N.  
 Description : Sucroglycerides are mixtures of mono- and di-esters of sucrose with mono and diglycerides. They are produced by trans esterification reaction between the triglyceride and sucrose at 90-92 C under a vacuum of 20 Hg. Following the purification and removal of the reaction solvent a paste like material results, which has useful non-ionic surface active properties. Sucroglycerides have been fractionated into oil soluble lipid products and water soluble sucrose esters by using ethyl acetate and n-butanol. Studies indicate the possibility of the preparation of sucrose esters under controlled conditions. Sucroglycerides serve as emulsifiers and stabilizers in various food products.  
 Report(s) : -  
 Papers Published : -



- 152 Project Title : A comparative study of the amylases of Aspergillus niger, A. candidus and salivary amylase with particular reference to their glycoprotein nature.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition Discipline.
- Project Category : Fundamental and Applied.
- Cost : Rs. 68,000/-.
- Duration : April 1979-March 1981.
- Sponsor(s) : Institute.
- Investigator(s) : Raghavendra Rao, M.R.; Shenoy, B.C.
- Description : Glucoamylase of the above microorganisms were purified by homogeneity by techniques like gel chromatography and ion exchange chromatography. Purified A. niger enzyme was treated with TNBS, FDNB, periodate and NaBH<sub>4</sub> separately and tested for activity. Periodate treated enzyme was unable to heat and lost activity on storage. NaBH<sub>4</sub> completely inactivated the enzyme. With A. candidus, the purified enzyme had a pH of 8.8 by isoelectric focussing. The optimum temperature and pH were 65°C and 4.8 respectively. The enzyme had a carbohydrate content of 15%. Its protein had a molecular weight of 71,000 (by SDS) and haved abnormally on Sephadex G-200 column. Immunologically, A. candidus enzyme was different from A. niger and Rhizopus enzymes. The equivalence point of the enzyme was 3.6  $\mu$ l and carboxyl and tyrosine groups were needed for its activity as shown by CD data.
- Report(s) : -
- Paper Published : -
- 153 Project Title : Studies on beta galactosidase of Kluyveromyces fragilis.
- Organisation : National Dairy Research Institute, Karnal 132 001.
- Project Category : Applied.
- Cost : -
- Duration : 1979-81.
- Sponsor(s) : ICAR
- Investigator(s) : Haripal Singh; Dutta, S.M.
- Description : The project aims to standardize the conditions optimal for production of beta galactosidase; to purify and study its properties; and to immobilize the enzyme by various techniques with a view to suggest the use of enzyme in dairy industry.
- Report(s) : -
- Papers Published : -
- 154 Project Title : Development of malt based syrups for use in food industries.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Microbiology and Fermentation Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 3,50,000/-.
- Duration : April 1980-March 1982.
- Sponsor(s) : Institute.
- Investigator(s) : Satyanarayana Rao, B.A. and others.
- Description : Proteolytic and amylolytic activities of seven commercial enzyme preparations were determined. Conditions were worked out for the determination of fermentable and non-fermentable sugars in worts. Effects of fungal amyloglucosidases on malt wort were studied. Five millets, viz. Setaria (Navane), P. miliare (Saame), P. miliaceum (Varagu), Echinoclova (Madira) and Paspalum (Haraka). were analysed for use in making the syrups and the levels of microbial enzymes and conditions for syrup making were optimised. Syrups were also made with hops and both wort and hops syrups were appropriately diluted and the resulting

wort/hopped wort was analysed for various constituents. They were also fermented with a suitable strain of brewer's yeast and the resultant beer analysed. Malt based syrups were also prepared for use in non-alcoholic beverages and found acceptable. Conditions for making these syrups have been standardised with reference to the level of protein and flavouring components. In malting studies of millets, levels of proteolytic and amylolytic enzymes formed during germination were studied. Suitability of the malts from different millets for making wort and beer was also studied.

Report(s) : -  
Paper Published : -

## PESTICIDES

- 155 Project Title : Studies on metabolism of pesticides.  
Organisation : Industrial Toxicology Research Centre, Mahatma Gandhi Marg, Lucknow-226001.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : CSIR  
Investigator(s) : Beg, M.V. and others.  
Description : The project investigates the toxicity and metabolism of pesticidal chemicals in a wide range of biological systems like plants, seeds, pollen and fresh water fishes.  
Report(s) : -  
Paper Published : 1. Anand, M and others. Electrical activity of brain in Endosulfan Toxicity. Ind. J. Pharmacol 12(4); 1980; 229-35.  
2. Anand, M. and others. Effect of endosulfan on bioelectrical activity of brain in rats. Veterinary and Human Toxicology 22(6); 1980; 385-7  
3. Beg, M.U. and others. Development of an experimental model for the evaluation of toxicity and metabolism of pesticides. In Proceedings of Indo-US Workshop on Biodegradable pesticides held at Lucknow 16-19 April 1979.  
4. Beg, M.U. Application of vegetation in Environmental Monitoring Programme. Symposium on Advances in Botanical Research, 3rd Botanical Conference of Indian Botanical Society, Dec.28-30, J. Ind. Bot. Soc. 59 (Supplement); 1980.  
5. Gupta, R.C. and Khanna, A.K. Pollen germination: a system for pesticidal assay and toxicity evaluation. (Sci. Cult. 47(2); 1981; 74).  
6. Khanna, R.N. and others. Distribution of endosulfan in cat brain. Bull. Environ. Contam. and Toxicol. 22; 1979; 72-9.  
7. Krishna Gopal, M and others. Endosulfan induced changes in blood glucose of cat fish. Clarias batrachus. J. Adv. Food 1(2); 1980; 68-71.  
8. Krishna Gopal and others. The acute toxicity of endosulfan to fresh water organisms. Toxicol. Lett. 7; 1981; 453-6.  
9. Misra, D. and others. Effect of endosulfan on blood glucose. Chemosphere. 9; 1980; 119-21.  
10. Mohini Anand and others. Effect of a neurotoxic pesticide, endosulfan on tissue blood flow in cats including regional cerebral circulation. Vet. and Human Toxicol. 23(4); 1981; 252-8



11. Trivedi, B.S. and others. Evaluation of endosulfan for its phytotoxic properties. 3rd Botanical Conference of India, Botanical Society, Dec.28-30, J. Ind. Bot. Soc. 59 (Supplement); 174

156 Project Title : Pharmacological and toxicological studies on pesticides.  
 Organisation : Industrial Toxicological Research Centre, Mahatama Gandhi Marg, Lucknow-226001.  
 Project Category : Fundamental and Applied.  
 Cost : -  
 Duration : 1980-1982.  
 Sponsor(s) : Industrial Toxicology Research Centre.  
 Investigator(s) : Matin, M.A. and others.  
 Description : The project aims to determine the toxic effects of various pesticides to find suitable therapeutic antidotes against the toxic effects; and the effect of the drugs in animals exposed to pesticides is also being studied.

Report(s) : -  
 Paper Published : 1. Agarwal, R. and Matin, M.A. "Effect of oximes and atropine on the level of blood glucose and cerebral glycogen in malathion treated rats. J. Pharm. Pharmacol. 1981, In press.  
 2. Bose, B.C. and others. Effect of solanaceous alkaloids on conditioned avoidance responses in trained animals. Current Science, 37; 1967; 433-434.  
 3. Bose, B.C. and others. Effect of solanaceous alkaloids on 5-hydroxytryptamine content of rat brain. J. Pharm/ Pharmacol. 18, 1966; 690-691.  
 4. Kar, P.P. and Matin, M.A. Duration of Diazinon induced changes in the brain acetylcholine of rats. Pharmacol. Res. Commun. 3; 1971; 351-354  
 5. Kar, P.P. and Matin, M.A. Possible role of GABA in paraxon induced convulsions. J. Pharm. Pharmacol. 24; 1972; 996-7  
 6. Kar, P.P. and Matin, M.A. Possible role of cerebral amino-acids in acute neurotoxic effects of DDT in mice. Europ. J. Pharmacol. 25; 1974; 36-39.  
 7. Kar, P.P. and Matin, M.A. Central effect of lignocaine in organophosphate convulsions. Pharmacol. Res. Commun. 4; 1972; 37-41.  
 8. Matin, M.A. and others. A possible neurochemical basis of the central stimulatory effects of pp'DDT. J. Neurochem. 36; 1981; 1000-1005.  
 9. Matin, M.A. and others. Role of striatal acetylcholine and free ammonia in the central stimulatory effects of pp'DDT in rats protective effects of barbiturates. Archives fur toxicol. 45; 1980; 29-35.  
 10. Matin, M.A. and Niger, F. A study of the effects of certain barbiturates on the level of striatal acetylcholine and convulsions in pp'DDT treated rats. Pharmacol. Res. Commun. 11; 1979; 371-377  
 11. Matin, M.A. and others. Role of striatal dopamine in delayed neurotoxic effects of organophosphorus compounds. Europ. J. Pharmacol. 35; 1976; 229-232.  
 12. Matin, M.A. Effect of paraxon on cholinesterase activity in certain brain regards of diabetics rats. Europ. J. Pharmacol. 29; 1974; 168-170.  
 13. Matin, M.A. and Kar, P.P. Comparison of the chronic effects of  $\alpha$ -chlordane and pp'DDT on the level of cerebral aminoacids and free ammonia in mice. Pharmacol. Res. Commun. 9; 1977; 613-619.

14. Matin, M.A. and Kar, P.P. Modification of pp'DDT induced convulsions by changes in the level of cerebral GABA in mice. *J. Neurochem.* 27; 1976; 978-981.
15. Matin, M.A. and Kar, P.P. Effect of barbiturats and isoniazid on cerebral hemisphere GABA content in pp'DDT treated mice. *Pharmacol. Res. Commun.* 6; 1974; 357-362
16. Matin, M.A. and Kar, P.P. Further studies on the role of GABA in paraxon induced convulsions. *Europ. J. Pharmacol.* 21; 1973; 217-221.
17. Matin, M.A. and Kar, P.P. Central effect of paraoxon in diabetic rats. *Biochem. Pharmacol.* 21; 1972; 285-286.
18. Matin, M.A. and Kar, P.P. Release of acetylcholine from the ileum of hyperthyroid animals. *Pharmacol. Res. Commun.* 4; 1972; 219-225
19. Matin, M.A. and Kar, P.P. Role of GABA and free ammonia in pp'DDT induced convulsions. Paper No.310. Presented at XXVI International Congress of Physiological Sciences, New Delhi 1974.
20. Matin, M.A. and Kar, P.P. Effect of cholinesterase inhibitors and PAM on the release of acetylcholine from the isolated guinea pig ileum. *Jap. J. Pharmacol.* 21; 1971; 563-567.
21. Matin, M.A. Correlation between EEG effects and acetylcholine content of brain after cholinolytic hallucinogens. *Jap. J. Pharmacol.* 19; 1969; 515-519.
22. Matin, M.A. and Vijayavargiya, R. Effect of atropine and hyoscine on acetylcholine content of certain parts of rabbit brain. *Jap. J. Pharmacol.* 18; 1968; 281-284.
23. Matin, M.A. and Vijayavargiya, R. Effect of atropine and hyoscine on tissue respiration and succinic dehydrogenase activity. *Ind. J. Med. Sci.*, 22; 1968; 169-170/
24. Matin, M.A. Solanaceous alkaloids and 5HT metabolism. *Ind. J. Med. Sci.* 24; 1979; 13-14.
25. Matin, M.A. and others. Effect of paraoxon on the accumulation of pp'DDT in certain brain regions of rats. *Experientia*, 1982, In press.

- 157 Project Title : Pesticide toxicity.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B Ashok Marg, Lucknow.  
 Project Category: : Applied.  
 Cost : -  
 Duration : 1981/82-1982/83.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Surjeet Singh and others.  
 Description : Different vegetables sprayed with pesticides like endosulphan, parathion and demecron will be studied by different gas chromatography for pesticide residues after different tag periods. Results of experiments with brinjals are encouraging.  
 Report(s) : Interim.  
 Papers Published : -
- 158 Project Title : Appraisal of pesticide toxicity and safety limits for ensuring consumer and environmental safety.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Infestation Control and Pesticide Discipline.  
 Project Category : Applied and survey.  
 Cost : Rs. 2,66,000/-.  
 Duration : July 1978-March 1981.



- Sponsor(s) : Institute.
- Investigator(s) : Krishna Kumari, M.K. and others.
- Description : This All India Coordinated Project aims to determine the mammalian toxicity and safety evaluation of various pesticides in foods and to generate toxicity and safety data for registration by Central Insecticide Board. The pesticides so far studied for oral and dermal toxicities include copper oxychloride, copper sulphate, BHC (technical) Lindane, warfarin (Technical), silmurin, antimony potassium tartrate, ethylene dibromide (EDB) manufactured in India, aromex, xylene, durobase, monocrotophos, DDVP, aldrex, ethion, dimethioate, miraculan, diflubenzuron pyrethrin (technical), cypermethrin, bromodiolone and brodifacoum. Sub-acute toxicities of some of the above pesticides as well as acute toxicities to poultry were also investigated. The safety limits for many of these pesticides have also been suggested on the basis of the studies.
- Report(s) : Final.
- Papers Published : 1. Krishna Kumari, M.K. and others. Evaluation of acute oral toxicity of zinc phosphide to *Ratus norvegicus* (albino). *Pesticides* 13(11); 1979; 33 .
2. Krishna Kumari, M.K. and others. Pesticides and mutagenicity implications. Presented at Third International Conference on Environmental Mutagens, Tokyo, Japan, September 1981 .
3. Krishna Kumari, M.K.. Mammalian toxicity of technical X-factor. 1. An acute oral study. *J. Environ. Sci. Health-B*. 17(3); 1982; 241 .
4. Majumder, S.K. and others. Some novel approaches in minimizing contamination and detoxifying toxic rodenticides. Presented at National Seminar on Rodent Research and Control, CAZRI, Jodhpur, February 1982 .
5. Muktabai, K. and others. Short term toxicity study of zinc phosphide in albino rats (*Ratus norvegicus*). *Indian J. Exp. Biol.* 18(8); 1980; 854, .
6. Muktabai, K. and others. Toxicity of calciferol, warfarin and their combinations to *Ratus norvegicus* (albino) and *R. rattus*. (*Pesticide Sci.* 9; 1978; 44).
7. Muralidhara and Krishna Kumari, M.K. Mammalian toxicity of aromex and xylene used in pesticidal formulations. (*Indian J. Exp. Biol.* 18(10); 1980; 1148).
8. Muralidhara and others. Toxic effects of repeated administration of aromex, a pesticidal carrier to albino rats. (Presented at Annual Meeting of Society of Biological Chemists (India), Chandigarh, November 1982 .
9. Muralidhara and others. Toxicity of some petroleum fractions used in pesticidal emulsions to albino rats. *J. Food Sci. Technol.* 19; 1982; 260 .
10. Rajani, P.S. and Krishna Kumari, M.K. Malathion poisoning in non-target species: an acute oral study in poultry. (*Gallus domestica*). *J. Food Sci. Technol.* 18(6); 1981; 231).
11. Rajani, P.S. and Krishna Kumari, M.K. Oral toxicity of dimethoate (tech.) to rats and mice. Annual Conference of EMSI, Madras, Feb. 1982 .
12. Rajani, P.S. and others. Tissue culture techniques in pesticide bioassay and toxicity studies. Presented at Colloquium on tissue culture system, CFTRI, Mysore, April 1981 .
13. Shivanandappa, T. and Krishna Kumari, M.K. Histochemical and biochemical changes in rats fed dietary benzene hexachloride. *Indian J. Exp. Biol.* 19; 1981; 1163 .

14. Shivanandappa, T. and others. Inhibition of steroidogenic activity in the adrenal cortex of rats fed benzene hexachloride (hexachlorohexane). *Experientia* 38; 1982; 1251.
15. Visweswariah, K. and others. Colorimetric method for the determination of human serum cholinesterase and its activity towards methyl paraxon. *Curr. Sci.* 48(12); 1979; 86.

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- 159 Project Title : Field trials with some newer insecticides in different eco-climatic zones for the preservation of food grains in godowns.
- Organisation : Indian Grain Storage Institute, P.O.Box 10, Hapur 245101.
- Project Category : Applied.
- Cost : -
- Duration : 1981-1983.
- Sponsor(s) : Government of India; Ministry of Agriculture, Department of Food.
- Investigator(s) : Varma, B.K. and others.
- Description : The project aims to find out effective and economic organophosphorus insecticides to control stored grain insect pests: Field testing of newer insecticides like pirimiphosmethyl phoxim, fenitrothion and methacritos are being done in different eco-climatic zones.
- Report(s) : -
- Paper Published : -
- 160 Project Title : Biochemical studies on BHC isomers.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition Discipline.
- Project Category : Fundamental.
- Cost : Rs. 1,81,000/-.
- Duration : March 1978-March 1981.
- Sponsor(s) : CSIR
- Investigator(s) : Radhakrishna Murthy, R; Srinivasan, K.
- Description : Biochemical changes induced by  $\beta$  and  $\gamma$ -isomers in albino rats were investigated. The potency of BHC isomers to induce drug metabolising enzyme was also tested and compared with phenobarbital. It was found that both BHC isomers could induce this system as early as 4 days and even at 50 ppm level in the diet. The distribution pattern of BHC residues in rat tissues as also the effect of diet restriction on the tissue redistribution of the residues were also studied. Studies on the effect of the isomers on lipid synthesis, transport and storage were also conducted using  $^{14}\text{C}$  labelled acetate and palmitate. After 2 weeks of oral BHC feeding at 880 ppm level in the diet, liver and kidney lesions were indicated, BHC isomers also increased the urinary excretion of protein, urea and creatinine.
- Report(s) : Final report.
- Papers Published : 1. Srinivasan, K. and Radhakrishna Murthy. Effect of beta and gamma isomers of hexachlorohexane (BHC) on some enzyme systems of albino rats. Presented at Annual Meeting of Society of Biological Chemists (India), Lucknow, October 1979.
2. Srinivasan, K. and Radhakrishna Murthy. Effect of hexachlorocyclonexane isomers on growth of *Neurospora* and *Saccharomyces* organisms. *Indian J. Microb.* 18; 1978; 113.

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- 161 Project Title : Screening and evaluation of indigenous plant materials for their insecticidal activity against storage and house hold pest.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Infestation Control and Pesticides Discipline.



Project Category : Fundamental and applied.  
 Cost : Rs.1,23,000/-.  
 Duration : 1978-1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Ahmed, S.M. and others.  
 Description : Plant powders such as Bougainvillea sp. Bassia longifolia, Acorus calamus, Psoralea coralifolia, Tylophora asthamatica, Cestrum nacturnum, Embellia ribes, Fumaria officinalis and Ruta graveolena when used at 10-40% level in the media, were effective in reducing the pupation of Musca domestica by 50-100%. At the same level, powders of Azadirachta indica (leaves and kernels), Nigella sativa, Carum roxburghianum and Caesalpinia bonduc showed 10-50% reduction in fly population. Most powders also reduced the adult emergence by 15-100%.

Report(s) : Final.

Papers Published : -

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162 Project Title : Newer and safe protectants for food industry and home environment.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Infestation Control and Pesticide Discipline.  
 Project Category : Applied.  
 Cost : Rs. 16,91,071/-.  
 Duration : June 1982-March 1984.  
 Sponsor(s) : CSIR  
 Investigator(s) : Majumder, S.K. and others.  
 Description : The project aims to evolve third generation pesticides to abate problems of health hazards and pollution. It also intends to evolve and evaluate formulations of advanced biodegradable pesticides like bromophos, pirimphos methyl, etc. for home scale and plant disinfection. The development of pheromones and biological products for screening against stored-product insects and household pests, is also being attempted. Utilization of silicophosphates and related inorganic minerals for seed and gram storage is brought to light and the role of heat disinfection and other physical methods for infestation control in small scale storage of grains is envisaged.  
 Report(s) : -  
 Papers Published : -

163 Project Title : Pest control strategies for rural development with an accent on environmental safety; a self sustaining programme.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Infestation Control and Pesticide Discipline.  
 Project Category : Applied and developmental.  
 Cost : Rs. 3,87,528/-.  
 Duration : 1979-1982.  
 Sponsor(s) : CSIR  
 Investigator(s) : Natarajan, CP. and others.  
 Description : This is a multi-disciplinary project aimed at developing, modifying and applying pest control techniques in post harvest storage of food grains in villages. The techniques/products developed included fumigants and fumigation techniques, thermal disinfection by solar energy exposure made possible by black tin container, fumigant diffusion through new packaging films, vacuum fumigation facility and spot fumigation of mills. Effect of sublethal doses of various chemical pesticides on productivity of Trogoderma granarium was also tested. Amount rural storage structures, bamboo bin containing paddy, plastered with

cow dung proved better in remaining fumigants like EDB than mud or papier mache plaster. Several simple methods for detection of fumigants were also developed. Other studies included newer application of fumigation (e.g. in LDPE packed Jamun mix), dursin as a soil fumigant control of domestic insect pests by fumigation, fumigants for rat burrows, prefabricated storage structures, atmospheric fumigation vaults with fumigant recirculation facility, nontoxic insecticides like clays, insect pheromones, pyrethroids, etc. Field trials using mobile laboratory were also conducted for monitoring, process control and efficiency evaluation of post control products, methods and equipment.

Report(s) : -  
Papers Published : -

## FOOD SCIENCE AND TECHNOLOGY

164 Project Title : Transfer of technology in village industries.  
Organisation : Indian Institute of Management, Vastrapur, Ahmedabad-380015.  
Project Category : Exploratory.  
Cost : Rs. 2 lakhs.  
Duration : 1980-1982.  
Sponsor(s) : Government of India, Ministry of Agriculture.  
Investigator(s) : Moulik, T.K.; Purushottam, P.S.  
Description : Data collection on energy food, operational methods in implementing transfer of technology of energy food processing and implications for future technology transfer policy are envisaged.  
Report(s) : -  
Papers Published : -

## Food Analysis

165 Project Title : Function as Central Food Laboratory for analysis of foods under section 13(2) of P.F.A. Act for the states of Haryana, Himachal Pradesh, Punjab, Rajasthan, Uttar Pradesh, Jammu and Kashmir and Union Territories of Chandigarh and Delhi.  
Organisation : Food Research and Standardisation Laboratory, Navyug Market, Ghaziabad-201001.  
Project Category : Applied.  
Cost : -  
Duration : April 1978-  
Sponsor(s) : Government of India, Ministry of Health and Family Welfare, New Delhi.  
Investigator(s) : Dhingra, P.K. and others.  
\*136

166 Project Title : Food analysis: Research, standardisation and collaborative work.  
Organisation : Central Food Laboratory, 3, Kyd Street, Calcutta-700016.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : -  
Investigator(s) : Guha, K.C. and others.  
\*137



167 Project Title : Studies on the frying of foods in oils.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Lipid Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 2,58,200/-.  
 Duration : March 1976-April 1979.  
 Sponsor(s) : CSIR  
 Investigator(s) : Potty, V.H. and others.  
 Description : In a model experiment, it was found that during heating of vanaspati at 180 C considerable damage was caused characterised by increase in epoxy acids, non urea adduct forming and oxidised fatty acids. There was also gradual reduction in iodine value and smoke point besides increase in FFA, retractive index and foaming height. Addition of silicone retarded the deteriorative changes. Heat damaged oil samples used for commercial frying were studied for non urea adduct forming fatty acids, oxidised fatty acids and oxirane oxygen. Magnesium oxide treatment and bleaching improved the quality of the samples. This treatment was therefore recommended for use when smoke point of heat damaged oil is not less than 160 or FFA is not more than 5% (as oleic acid).  
 Report(s) : Final.  
 Papers Published : 1. Sulthana, S.N. and others. Quality of oil in frying media and deep-fat fried products presented at the First Indian Convention of Food Scientists and Technologists, AFST & CFTRI, Mysore, June 1978 .  
 2. Sulthana, S.N. and others. Quality of oil in deep fat frying oil and deep fat fried products. Presented at the International Congress of Oilseeds and Oils, Oil Technologists Association of India, Delhi, 1979.  
 3. Sulthana, S.N. and Sen, D.P. Studies on deep-fat frying during heating of oil. J. Food Sci. Technol. 16(5); 1979; 208.

\*139

168 Project Title : Evaluation of products from other disciplines and industries.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Sensory Evaluation Discipline.  
 Project Category : Applied.  
 Cost : Rs. 2,69,500/-.  
 Duration : Jan.1975-March 1979.  
 Sponsor(s) : CSIR  
 Investigator(s) : Govindarajan, V.S. and others.  
 Description : The project involved evaluation of important varieties of apples from different regions in relation to optimum maturity, transport and storage as also various products developed at the institute like ready-to-serve beverages, cola type beverages, tomato paste, mango slice in syrup, dried green gram dhal, stored (60 days at 27 C) dehydrated mushroom packaged in aluminium foil and HDPE, frozen stored fruits and vegetables. Evaluation studies were also conducted on lactic acid (for use as acidulant), protein chewy candy, rum packed in HDPE containers, concentrated gravies and a host of other products. Developed by the institute and available from commercial sources.  
 Report(s) : Final.  
 Papers Published : 1. Govindarajan, V.S. and others. Sensory quality evaluation of papads: quality profile technique and development of a composite scoring scale. Indian J. Nutr. Dietet. 8; 1971; 249-59 .

2. Dhanaraj, S. and others. Quality evaluation of apples: Development of a descriptive quality profile for sensory quality. Presented at First Indian Convention of Food Scientists and Technologists, AFST (India) and CPTRI, Mysore, June 1978

\*146

- 169 Project Title : Monitoring and survey of the quality of the foods and food products produced and sold in Ghaziabad region.  
 Organisation : Food Research and Standarization Laboratory, Navyug Market, Ghaziabad-201001.  
 Project Category : Survey.  
 Cost : -  
 Duration : September 1975-  
 Sponsor(s) : Government of India, Ministry of Health and Family Welfare, New Delhi.  
 Investigator(s) : Dhingra, P.K. and others.  
 \*147
- 170 Project Title : Sensory evaluation for fresh, stored and processed foods and beverages.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Sensory Evaluation Discipline.  
 Project Category : Applied.  
 Cost : Rs. 4,82,500/-.  
 Duration : April 1979-March 1984  
 Sponsor(s) : Institute  
 Investigate(s) : Govindarajan, V.S. and others.  
 Description : Effects of process techniques like storage methods, bulk preservation techniques deacidification techniques, dehydration, stunning techniques, ageing, cooking methods etc. on the various sensory quality parameters of various fresh and processed foods and beverages are being evaluated by sensory evaluation techniques.  
 Report(s) : -  
 Papers Published : 1. Govindarajan, V.S. and Rajalakshmi, D. Sensory evaluation in quality control of foods. J. Food Sci. Technol. 17 (V. Subramanyan Commemoration issue); 1979; 104
- 171 Project Title : Nutritional evaluation of a rural diet supplemented with low cost, locally available foods through human feeding trials.  
 Organisation : Sri Avinashilingam Home Science College for Women, Coimbatore-641001.  
 Project Category : Applied and Exploratory.  
 Cost : Rs. 5,15,644/-.  
 Duration : August 1975-August 1980.  
 Sponsor(s) : College  
 Investigator(s) : Devadas, R.P. and others.  
 \*148
- 172 Project Title : Assessment of the nutritive value of the south Indian diet.  
 Organisation : Tamil Nadu Agricultural University; Agricultural College and Research Institute, Coimbatore-641003; Biochemistry Department.  
 Project Category : Applied and Survey.  
 Cost : Rs. 10,000/-.  
 Duration : January 1975-January 1980.  
 Sponsor(s) : University.  
 Investigator(s) : Sadasivam, S.  
 \*149



- 173 Project Title : Use of extrinsic tagging  $^{65}\text{Zn}$  to determine Zn availability from foods.
- Organisation : National Institute of Nutrition, Tarnaka, Hyderabad -500007.
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : ICMR
- Investigator(s) : -
- Description : The isotopic method has been extended to study Zn absorption by observing the exchanges of added radio Zn with native Zn. Test foods were spiked with Zn and enzymatically digested first with pepsin HCl at 65% 35 and subsequently the pH was changed to 7.4. Stable as well as  $^{65}\text{Zn}$  in the supernatant at the above pH corresponding respectively to gastric and duodinal pH were determined by using atomic absorption spectrophotometry for stable Zn and in a well type scintillation detector for  $^{65}\text{Zn}$ . The extent of isotope exchange was evaluated by comparing the specific radio activities of the food and the different supernatant fractions. Result showed Zn in most foods was almost completely soluble at pH 1.35, the solubility decreasing considerably at pH 7.4 depending upon the food. The variation in solubility at pH 7.4 ranged from 8.65% of total Zn in foods. In cases where both radio active and intrinsic Zn contents were determined, the specific activity was similar. The data indicated that there was a free exchange of added  $^{65}\text{Zn}$  with native Zn and suggested the feasibility of using this method to study Zn absorption. This was demonstrated using several homogenised and dried samples of composite meals based on different food ingredients. Experiments are underway to measure Zn absorption in monkeys using this method.
- Report(s) : Annual Report.
- Papers Published : -
- 174 Project Title : N-nitrosamine in foods.
- Organisation : University of Bombay, Department of Chemical Technology, Matunga Road, Bombay-400019.
- Project Category : Applied.
- Cost : Rs. 7,000/-.
- Duration : 3 years.
- Sponsor(s) : University Grant's Commission, New Delhi.
- Investigator(s) : Jadhav, S.S.; Kulkarni, P.R.
- Description : Pressor amines nitrosamines, nitrate and nitrite contents of various foods have been investigated. The possible role of microorganisms in nitrosamine formation in fermented foods; the possibility of development of nitrosamines under conditions simulating gastrointestinal tract, from common drugs having nitrosatable moieties and nitrosamine formation during Maillard reactions are also being investigated.
- Report(s) : -
- Papers Published : 1. Jadhav, S.S. and Kulkarni, P.R. Pressor Amine in Foods J. Fd. Sci. Tech. 18; 1981; 156
2. "Nitrosamines in Indian Fermented Foods". Presented at the International Conference on Food Science and Technology, Mysore, May 1982 by Jadhav, S.S. and Kulkarni, P.R.

## Food Processing

- 175 Project Title : Development of facilities for harnessing solar energy for food dehydration.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Process Development and Design Discipline.
- Project Category : Applied.
- Cost : Rs. 3,76,000/-.
- Duration : September 1979-February 1981
- Sponsor(s) : Institute.
- Investigator(s) : Ramakrishna, P. and others.
- Description : Plastic collectors made from polyethylene, polypropylene and PVC were evaluated for efficiency in air heating. Three layer PVC collectors were found suitable for small-scale heating. Polyethylene covers were tried in a cabinet dryer (100 cm x 65 cm) with products such as dessicated coconut, carrot slices and lady's fingers. A maximum temperature rise of 30 C (i.e. from an ambient 30 C to 60 C) as observed. Provision of an extra polythene cover with a gap of 5 mm between the two covers gave a maximum temperature rise of 40 C without loading the cabinet. The maximum temperatures with single and double shielding covers were around 50 C and 55 C respectively even with material in the cabinet. Solar drying was studied in through-flow dried and a wooden, black PVC lined solar collector (10 sq.m. absorbing area) fabricated at the institute, with seedless grapes. Compared to sun drying, the grapes could be dried in the solar drier at temperatures of 25-30 C above ambient temperature. A moisture content of 11% was obtained in 10 hours as compared with 14 days in sundrying. Colour of the solar dried grapes was superior to that of sundried ones.
- Report(s) : -
- Papers Published : -
- 176 Project Title : Studies on the heat processing and storage characteristics of liquid foods and pulps.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Process Development.
- Project Category : Applied.
- Cost : Rs. 1,60,000/-.
- Duration : Sep.1982-Aug.1984.
- Sponsor(s) : Institute.
- Investigator(s) : Srinivasa Rao, P.N. and others.
- Description : A continuous heat sterilisation and sponsor filling unit for liquid foods consisting of double pipe heat exchanger has been set up with a capacity of 4 l/min. Initial trials conducted with water and mango pulp showed that the unit could not attain temperature higher than 90 C. Cooling trials were conducted with water and mango pulp in S.S. containers and plastic containers using air and water as cooling media. The apparent viscosity of mango pulp at various temperatures and concentrations has been estimated. A batch (10-15 kg) husk pyrolysis unit has been fabricated. Gasification studies conducted on the unit show that there is a discontinuous production of gas. A batch soxhlet extraction system for handling 10 kg of wet coffee beans has been erected in the pilot plant with necessary utility and other service connections. Studies on the decaffination of green coffee beans were also carried out using the ethylene chloride as solvent. It was observed that about 98% of the caffeine present in the beans can be removed in 18-20 contacts with solvent.
- Report(s) : -
- Papers Published : -



- 177 Project Title : Freeze drying of food materials.  
 Organisation : Bhabha Atomic Research Centre, Bombay-470085  
 Project Category : Applied (Design and fabrication of 1 kg and 10 kg capacity freeze dryers were complete in collaboration with two Division of Centre for carrying out experiments on freeze drying of food materials on small and large scale)  
 Cost : Approx. Rs.75,000 for 1 kg capacity freeze dryer; Rs.1.6 lakhs for 10 kg capacity freeze dryer.  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Bongirwar, D.R.; Thirumaleshwar, M.  
 Description : See papers published.  
 Report(s) : -  
 Papers Published : 1. Freeze Drying of food materials. Bongirwar, D.R. and Thirumaleshwar, M. Vac. News. 9(1); 1978; 11  
 2. Freezing & Freeze drying of foods. Bongirwar, D.R. Proc. of Indian Vacuum Society's Workshop on Freeze Drying, Bombay, pp.51-59, 1980.
- 178 Project Title : Food irradiation facilities at Trombay; its design considerations and dosimetry methods in food irradiation procedures.  
 Organisation : Bhabha Atomic Research Centre, Bombay-470085.  
 Project Category : Applied (The food irradiators were installed at FIPLY and are being used since 1967 for radiation preservation of foods on semi-pilot scale)  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Bongirwar, D.R. and staff of Food Engg. Section  
 Description : See papers published as given below.  
 Report(s) : -  
 Papers Published : 1. Report on BARC programmes in food irradiation, Design of Cobalt-60 irradiators viz. package and throughflow at FIPLY and problems of dosimetry in food irradiation procedures. Bongirwar, D.R. Proc. of Joint BARC/IAEA/FAO Seminar on Food Irradiation, Bombay, 1969, pp. 68-69.  
 2. Radiation sources and its design aspects. Bongirwar, D.R. Paper presented at IAEA/FAO/DAE International Training Course in Food Irradiation Technology and Techniques, Bombay, Nov.1 to Dec.10, 1971, 1-13.  
 3. Radiation dosimetry. Bongirwar, D.R. Paper presented at IAEA/FAO/DAE International Training Course in Food Irradiation Technology and Techniques, Nov.1 to Dec.10, 1971, pp.1-10.  
 4. Design considerations of industrial gamma irradiators. Bongirwar, D.R. Proceedings of H.B.T.I. Seminar on Plant Design and Operation, Kanpur 1973, pp.29-34.  
 5. Cobalt borosilicate glass dosimeter. Bongirwar, D.R. Proc. of 1st Annual Conference of Indian Association for Radiation Protection, Bombay, 1973, pp.24-26.  
 6. Cellulose triacetate dosimeter. Bongirwar, D.R. Proc. of 1st Asian Regional Congress on Radiation Protection, Bombay, IARP 3/90, 1974 pp.75-77.  
 7. Radiation safety measures in food irradiation plant. Bongirwar, D.R. Proc. of 3rd National Conference of International Association of Radiation Protection, New Delhi, 1976, pp. 20-24.  
 8. Food Irradiation facilities at Trombay. Bongirwar, D.R. Proc. of National Symposium on isotope application in industry. BARC, Trombay, Bombay, 1977, pp.354-363.

## Food Hygiene and Sanitation

- 179 Project Title : Pesticide residue analysis in food materials and body tissues.  
 Organisation : Industrial Toxicology Research Centre, Mahatma Gandhi Marg, Lucknow-226001.  
 Project Category : Applied and Exploratory.  
 Cost : -  
 Duration : -  
 Sponsor(s) : CSIR  
 Investigator(s) : Seth, T.D. and others.  
 Description : The project aims to estimate the pesticide residues in food materials and body tissues by different analytical techniques.  
 Report(s) : -  
 Papers Published : 1. Kaphadia, B.S. and Seth, T.D. Contamination of organochlorine pesticides in the body tissues of domestic food animals and chicken. Pesticide Monitoring Journal (special issue); 1981.  
 2. Seth, T.D. and Kaphadia, B.S. 1,2,3,4,5,6-Hexa chlorocyclohexane (HCH) residues in tissues of sheep. Vet Human Toxicol. 23; 1981; 247-8
- 180 Project Title : Monitoring of food contaminants.  
 Organisation : Central Agmark Laboratory, Nagpur-440010.  
 Project Category : Survey.  
 Cost : Rs. 28,000/-.  
 Duration : 1981-1982.  
 Sponsor(s) : Directorate of Marketing and Inspection.  
 Investigator(s) : Mathew, T.V. and others.  
 Description : Determination of heavy metallic contaminants in food commodities (lead, arsenic, mercury, cadmium), based on FAO recommendations. 120 samples of cereals, spices were collected from local market for this purpose. The results on these from five collaborating laboratories will be compiled.  
 Report(s) : -  
 Papers Published : -
- 181 Project Title : Iron contamination of foods.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad-500007.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : Foods purchased from the market are often contaminated with iron derived from dust. The availability of the contaminant iron has been studied in common cereals (rice, wheat, jowar and ragi and pulses (bengal gram, green gram and blackgram dhals). Total iron content after dry washing and ionisable iron content (as purchased, after washing and after washing and milling) were analysed. The difference in the ionisable iron content as purchased and after washing was taken as a measure of availability of contaminant iron. Similarly ionisable iron content between the 'washed' and 'washed and milled' samples was taken as a measure of availability of iron acquired during milling. The result show that iron contamination for cereals purchased from shops exhibited large variations (13-46%). With pulses the variations were within smaller margins (13-25%). There were negligible differences in absolute ionisable iron content between 'as purchased' and 'washed' samples, indicating that almost the entire contaminant iron was nonionisable and therefore poorly available. Contamination during milling also showed wide



varitions (47% and 154%). However, increase in ionisable iron after milling was less than 1%. It was clear that none of the contaminant iron is available and thus calculating the iron content of foods from food tables may often over estimate their available iron content.

- Report(s) : Annual.
- Papers Published : 1. Prabhavathi, T. and Narasinga Rao, B.S. Contaminant iron in foods and its bioavailability as predicted by in vitro methods. Indian J. Med. Res. 74; 1981; 37-41.
- 182 Project Title : A study on the extent of prevalence of food adulteration in Trivandrum district.
- Organisation : Kerala Agricultural University; College of Agriculture, Vellayani, Trivandrum-695522; Department of Agricultural Extension, Food Science and Nutrition Section.
- Project Category : Exploratory.
- Cost : -
- Duration : 1981-1984.
- Sponsor(s) : University.
- Investigator(s) : Mary Ukkuru, P. and Prema, L.
- Description : The assessment of the extent of food adulteration in Trivandrum District, Kerala, and the awareness of the housewives regarding the problem is programmed. Methods of educating the housewives to detect common adulterants are also envisaged.
- Report(s) : -
- Papers Published : -
- 183 Project Title : Bacteriological study on water stored in different types of vessels.
- Organisation : National Institute of Nutrition, Tarnaka, Hyderabad-500007.
- Project category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : ICMR
- Investigator(s) : -
- Description : Well water stored for 24 hours usually in vessels such as mud pots, brass, steel and aluminium in rural areas were studied. The water from the wells were also tested for bacterial counts before storage. Water samples from all the 8 wells selected in this study showed fairly high bacterial counts (colony forming units,  $2.0-4.04 \times 10^3/\text{ml}$ ; and presumptive coliform counts, 90-180/100 ml). During storage in mud vessels, no change in bacterial counts were observed for the first ten hours and there was only a slight increase in counts at 24 hours. On the other hand, water stored in all the metal vessels showed 24-25 fold increase in bacterial count in 24 hours. The absence of bacterial growth in mud pots was attributed to its absorptive property. Silica or clay do not seem to have any inhibitory effect.
- Report(s) : Annual.
- Papers Published : -
- 184 Project Title : Trace element content of drinking water stored in containers of different metals.
- Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : ICMR
- Investigator(s) : -

- Description : Tap water samples were stored for 24 hours in plastic, stainless steel, copper, brass or aluminium vessels and analysed for Mg, Cr, Cu, Mn and Zn. Result showed that contribution of these trace elements to water attributable to the above containers was negligible. However, water collected from houses, stored in copper or brass, vessels showed higher level of Cu or Zn. This was attributed to possible contamination through dust or handling.
- Report(s) : Annual.
- Papers Published : -
- 185 Project Title : Effect of cooking diets in different vessels on trace element content.
- Organisation : National Institute of Nutrition, Tarnaka, Hyderabad - 500 007
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : ICMR
- Investigator(s) : -
- Description : The cooking vessels (aluminium, stainless steel, brass after tinning or mud pots) are likely to contaminate the diets cooked in them with trace elements derived from the vessels. The extent of contamination in diets of three regions, u.P., Maharashtra and Andhra Pradesh, cooked in different types of vessels were investigated using atomic absorption spectrophotometry. No significant differences were evident in trace element contents of foods cooked in different types of vessels. However, when freshly tinned brass vessels, were used for cooking, they contributed significantly to the trace element contents, particularly Zn and Cu to the diet. No such contamination was evident with tinned brass vessels which have been in use for some time.
- Report(s) : -
- Papers Published : -

#### Microorganisms and Toxins in foods

- 186 Project Title : Food contamination monitoring study India and Nepal.
- Organisation : Industrial Toxicology Research Centre, Mahatma Gandhi Marg, Lucknow-226001.
- Project Category : Survey.
- Cost : Rs. 50,000/-.
- Duration : May 1981-May 1982.
- Sponsor(s) : Directorate General of Health Services; Food and Agricultural Organisation of the United Nations (FAO).
- Investigator(s) : Seth, T.D. and others.
- Description : Pesticide residues, heavy metals and aflatoxins in food samples are being estimated.
- Report(s) : -
- Papers Published : -
- 187 Project Title : Monitoring of food samples for the presence of organochlorine insecticide residues.
- Organisation : Indian Grain Storage Institute, Post Box 10, Hapur-245101
- Project Category : Applied.
- Cost : -
- Duration : 1981-1983.
- Sponsor(s) : Government of India, Ministry of Agriculture; Department of Food.



- Investigator(s) : Varma, B.K. and others.  
 Description : Screening of food samples by gas liquid chromatography to detect the presence of organo-chlorine insecticides residues has been carried out.  
 Report(s) : -  
 Papers Published : -
- 188 Project Title : Screening of different organic acids and fungicides for the control of seed borne diseases and storage fungi.  
 Organisation : Indian Grain Storage Institute, PB No.10, Hapur-245101.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981.  
 Sponsor(s) : Government of India; Ministry of Agriculture and Irrigation; Department of Food.  
 Investigator(s) : Singh, T; Tyagi, R.P.S.  
 Description : The project intends to find out the suitable fungicides for the control of seed borne diseases and storage fungi.  
 Report(s) : -  
 Papers Published : 1. Singh, T., Tyagi, R.P.S. and Baburam. Bavistin and Bavistin + TMTD as effective fungicide for control of storage fungi. (to be published).
- 189 Project Title : Aminoacid composition of fungal and bacterial infected food grains.  
 Organisation : Nagpur University; Laxminarayan Institute of Technology; Nagpur; Food Technology Section.  
 Project Category : Fundamental.  
 Cost : -  
 Duration : 1975 onwards.  
 Sponsor(s) : University.  
 Investigator(s) : Rao, B.Y. and others.  
 Description : The project aims to record the changes in the aminoacid make-up of cereals and legumes, infected with the microorganisms; to isolate and identify the toxic metabolites; and to investigate the effect of storage conditions on the nutritional quality of seeds.  
 Report(s) : -  
 Papers Published : 1. Garde, V.K. and Rao, B.Y. Aminoacid profile of sound and ergot infected Bajra (*Pennisetum typhoides*). Indian Food Packer. 32; 1978; 22.
- 190 Project Title : Isolation and identification of microflora from different food grains, animal and poultry feeds and milled products.  
 Organisation : Indian Grain Storage Institute, Hapur-245101  
 Project Category : Applied.  
 Cost : -  
 Duration : April 1981-March 1982.  
 Sponsor(s) : Government of India, Ministry of Agriculture and Irrigation, Department of Food.  
 Investigator(s) : Singh, T; Tyagi, R.P.S.  
 Description : The presence of different types of fungi and bacteria associated with the stored, milled products is investigated. 282 samples of different commodities like wheat, paddy, rice, maize, bajra, sorghum are screened.  
 Report(s) : -  
 Papers Published : -

- 191 Project Title : Post-harvest infestation, infection, adulteration and its detection in spices and related foods.  
 Organisation : Regional Research Laboratory, Trivandrum.  
 Project Category : Exploratory.  
 Cost : Rs. 3.5 lakhs.  
 Duration : 1979-1983.  
 Sponsor(s) : CSIR  
 Investigator(s) : Sreedharan, V.P.  
 Description : The project aims to build up facilities in the fields of microbiology and entomology. It intends to identify the microbial pests and insects in spices and their inhibition. Adulterants in spices and related foods have also been by staining technique. It has been found that the iodine staining can differentiate black pepper from papaya seed.  
 Report(s) : -  
 Papers Published : 1. Sreedharan, V.P. and others. Staining technique for differentiation of papaya seed from black pepper. J. Food Sci. Tech. 18(6); 1981;
- 192 Project Title : Rapid methods for microbiological analysis.  
 Organisation : University of Bombay, Department of Chemical Technology, Matunga Road, Bombay-400 019.  
 Project Category : Fundamental and Applied.  
 Cost : Rs. 5,000/- per year.  
 Duration : 2 years.  
 Sponsor(s) : Department of Industries, Govt. of Maharashtra, Bombay-400001.  
 Investigator(s) : Barve, S.S.; Kulkarni, P.R.  
 Description : A new rapid viable staining method based on Acridine orange staining has been developed which correlates excellently with S.P.C. method. A rapid method based on Ethedim Bromide development technique has also been standardised to detect thermolysin to monitor enterotoxigenic Staph. aureus contamination of foods.  
 Report(s) : -  
 Papers Published : 1. Barve, S.S. and Kulkarni, P.R. A rapid A-O vital staining method. Presented at International Conference on Food Science and Technology, Mysore, May 1982.
- 193 Project Title : Investigations on the saprozoönolic effect of fungus spoiled food grains on human/animal health: Search for preventive measures.  
 Organisation : Chandrasekhar Azad University of Agriculture and Technology; College of Veterinary Science and Animal Husbandry, Mathura, U.P.  
 Project Category : Exploratory and Survey.  
 Cost : Rs. 5,500/-.  
 Duration : July 1980-June 1982.  
 Sponsor(s) : University Grants Commission.  
 Investigator(s) : Sazena, Suresh Chandra.  
 Description : The incidence of food borne mycotoxicity among men and animals is being surveyed to suggest preventive measures. The survey has disclosed significant amounts of toxigenic fungi in food materials like, for example, wheat flour (66.6%), groundnut (80%), etc.  
 Report(s) : -  
 Papers Published : -
- 194 Project Title : Monitoring of mycotoxins in food grains and their estimation.  
 Organisation : Indian Grain Storage Institute, PBNo. 10, Hapur-245107.  
 Project Category : Applied.



- Cost : -  
Duration : 1979 onwards.  
Sponsor(s) : Government of India, Ministry of Agriculture and Irrigation, Department of Food.  
Investigator(s) : Singh, T; Tyagi, P.S.  
Description : The presence of mycotoxin in food grains under different conditions, qualitatively and quantitatively are being investigated. 221 samples of different food commodities were analysed for the contamination of aflatoxin B<sub>1</sub>.  
Report(s) : -  
Papers Published : 1. Singh, T; Tyagi, R.P.S. and Verma, B.K. Study on the occurrence of aflatoxin B<sub>1</sub> in food grains. J. Food Sci. Tech. 19(1); 1982; 35.
- 195 Project Title : Mycotoxins in stored food grains.  
Organisation : Indian Grain Storage Institute, Hapur-245101.  
Project Category : Applied.  
Cost : -  
Duration : 1978-1979.  
Sponsor(s) : Government of India, Ministry of Agriculture and Irrigation, Department of Food, New Delhi 110 001.  
Investigator(s) : Srivastava, D.D.; Shastri, R.P.  
\*222
- 196 Project Title : Studies on mycotoxins in fruits and vegetables and other foods.  
Organisation : Central Food Technological Research Institute, Mysore-570013; Microbiology and Fermentation Technology Discipline.  
Project Category : Applied.  
Cost : Rs. 4,50,000/-  
Duration : April 1982-March 1985.  
Sponsor(s) : Institute  
Investigator(s) : Shanta, T. and others.  
Description : Good and partially spoilt vegetables bought from different vendors of the local market were analysed for mycotoxins. The method involves the initial extraction with ethyl acetate, silica gel column cleanup using benzene + ethylene acetate as eluant and TLC analysis of the concentrated extract along with standard mycotoxins. Out of 20 lime samples one showed citrinin contained penicillic acid and another had patulin. Carrot and potato samples showed some fluorescent spot, which was not present in the control samples.  
Report(s) : -  
Papers Published : -
- 197 Project Title : Analytical and toxicological studies on the mycotoxins associated with dry fruits and spices.  
Organisation : Bhagalpur University, Bhagalpur-812007; Post-graduate Department of Botany.  
Project Category : Survey.  
Cost : Rs. 99,000/-.  
Duration : 1980-1983.  
Sponsor(s) : University Grants Commission.  
Investigator(s) : Bilgrami, K.S. and others.  
Description : The project aims to study the various mycotoxins associated with dry fruits and spices which may cause liver cancer and to suggest possible control measures.  
Report(s) : -  
Papers Published : -

- 198 Project Title : Survey for the presence of mycotoxins with special reference to patulin, sterigmatocystin, ochratoxin and penicillic acid in foods, food products, animal feeds and concentrates available in Tamil Nadu region of India.
- Organisation : Tamil Nadu Agricultural University; Agricultural College and Research Institute, Coimbatore-641 003; Food Technology Department.
- Project Category : Survey.
- Cost : Rs. 1,68,000/-.
- Duration : August 1976-August 1979.
- Sponsor(s) : University.
- Investigator(s) : Neelakantan, S. and others.
- \*157
- 199 Project Title : Investigations on the protective factors counteracting the effect of dietary mycotoxins.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Microbiology and Fermentation Technology Discipline.
- Project Category : Fundamental and applied.
- Cost : Rs. 7,65,000/-.
- Duration : April 1977-March 1982.
- Sponsor(s) : CSIR
- Investigator(s) : Basappa, S.C. and others.
- Description : Thymine exhibited a counteraction against aflatoxin B1 in bacterial systems. This mechanism seemed to be due to inhibitory effect of aflatoxin B1 on the biosynthesis of pyrimidine and reversal of the toxic effect by the exogenous supply of thymine. Orotic acid 5 'UMP and folic acid could also counteract against aflatoxin, folic acid being stronger than thymine. It was also shown that thymine specifically requires folic acid for its counteraction and that it lost its counteracting ability in the presence of aminopterin.
- Report(s) : -
- Papers Published : 1. Prema Viswanath and others. Counteraction of inhibitory effects of aflatoxin in *Bacillus megaterium*. J. Food Sci. Technol. 18; 1981; 92.
2. Rati, E.R. and others. The synergistic effect of aflatoxin B1 and aflatoxin A in rats. J. Food Sci. Technol. 18; 1981; 176.
- 200 Project Title : Detection and estimation of aflatoxin in foods.
- Organisation : Central Food Laboratory, 3 Kyd Street, Calcutta-700 016.
- Project Category : Applied and Survey.
- Cost : -
- Duration : -
- Sponsor(s) : Laboratory.
- Investigator(s) : Guha, A.K. and others.
- \*159
- 201 Project Title : Studies on the sanitation of food processing plant and restaurants with special reference to indicative microorganisms and Enterotoxins of health significance.
- Organisation : Central Food Technological Research Insitute, Mysore-570013; Microbiology and Fermentation Technology Discipline
- Project Category : Fundamental and applied.
- Cost : Rs. 2,64,218/-.
- Duration : April 1977-March 1980.
- Sponsor(s) : CSIR
- Investigator(s) : Dwarakanath, C.T. and others.
- Description : Several hotels in Mysore city were surveyed for microorganisms of public health significance and enterotoxins. Results showed



that cutlery and food handling carried significant amount of coliforms, coagulase positive Staphylococci and Enterococci. No differences existed between vegetarian and non-vegetarian establishments in respect of total and Coliform counts. The infecting microorganisms were studied for their multiplication and pathogenicity.

Report(s) : Final.  
 Papers Published : 1. Dwarkanath, C.T. and others. Prevalence and levels of coliforms, coagulase positive Staphylococci and Enterococci in catering establishments. Arogya, 5; 1979; 37 .

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202 Project Title : Distribution of enterotoxins and enterotoxigenic bacteria in foods.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Microbiology and Fermentation Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 3,85,000/-.  
 Duration : May 1980-April 1983.  
 Sponsor(s) : Institute.  
 Investigator(s) : Dwarkanath, C.T. and others.  
 Description : Control of microbial contamination of water by using oligodynamic action of metal ions was explored. Experiments with copper in the form of copper foil (even at 2.8 ppm of ion/ml) did not inhibit Escherichia coli. Hydrogen peroxide could be used for rendering drinking water safe at a very small cost. A quick method of assessing bacteriological quality of water was developed. Similarly methods were developed for assessing various food products including milk based products and spices. Data was generated in respect of a variety of products.  
 Report(s) : -  
 Papers Published : -

### Food Constituents

203 Project Title : Studies on carbohydrates (with special reference to unavailable fraction) of some-staple Indian foods and dietaries.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 2,02,827/-.  
 Duration : April 1977-March 1979.  
 Sponsor(s) : CSIR  
 Investigator(s) : Shurpalekar, K. and others.  
 Description : Conventional method and detergent and enzymatic methods of obtaining crude fibre values were compared with 10 foodstuffs. The values given by the convention method were found to be under estimated while the values given by the other two methods were similar. Ragi and Italian millet were studied for chemical composition and physicochemical characteristics of their starches. The starches had an amylose content of 16-18% and gelatinisation temperature of 60-72 C. They were non-ionic and represented single stage swelling and solubility behaviour. Ragi carbohydrates were comparable to corn starch in in-vitro digestibility. Though cooked diets improved diet intake of rats, feed efficiency ratio (FER) on raw diets was higher than on cooked diets. Ragi flour and isolated ragi starch were compared

by incorporation in the diets and the N retention in rats fed the former diet was lower than those fed the latter diet. The carbohydrate digestibility of ragi flour diet was also slightly lower than the ragi starch diets. In studies on field bean starches, a pectin-like fraction was isolated in yields of 5-6% from the husk. With diets comprising whole field bean or kernel the food transit time was reduced in rats. Husk did not show this diet. All fractions increased the faecal bulk of the rats.

Report(s) : Final.

Papers Published : 1. Mallikarjuna, G. and others. Carbohydrate make ups of minor millets. Die Starke 34; 1982; 397.  
2. Paramahans, S.V. and Tharanathan, R.N. Scanning electron micrography of enzyme digested Varagu starch granules. Die Starke 34; 1982; 73).  
3. Tharanathan, R.N. and others. Amylolytic susceptibility of native groundnut and Ragi starch granules as viewed by scanning electron microscopy. Die Starke 32; 1980; 158.

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### Processed foods

- 204 Project Title : Studies on hay box: Thiamine content of foods cooked in hay box.  
Organisation : University of Agricultural Sciences; Home Science College, Dharwad-580 005.  
Project Category : Applied.  
Cost : Rs. 10,000/-.  
Duration : August 1978-  
Sponsor(s) : University Grants Commission, New Delhi.  
Investigator(s) : Padnis, L.; Rama Rao.  
\*165
- 205 Project Title : ERH studies of raw materials and finished products.  
Organisation : Cadbury India Limited, Cadbury House, Bhulabhai Desai Road, Bombay-400 026.  
Project Category : Applied.  
Cost : Rs. 40,000/-.  
Duration : December 1977-December 1979.  
Sponsor(s) : Company.  
Investigator(s) : Shenoy, R.D.; Dumasia, M.D.  
\*166

### Special foods

- 206 Project Title : High protein low cost snack foods.  
Organisation : Britannia Industries Ltd; Research and Development Division, Plot 112, Street 13. Marol MIDC, Andheri East, Bombay-400093.  
Project Category : Applied.  
Cost : -  
Duration : Project closed.  
Sponsor(s) : Company.  
Investigator(s) : Krishnaswamy, S.V. and others.  
Description : Studies revealed that locally made extruders are not satisfactory to produce snack foods of acceptable textural quality and consistency.  
Report(s) : Report for company circulation only.  
Papers Published :



- 207 Project Title : Development of high protein ready-to-eat foods from defatted groundnut and soyabean by extrusion cooking.  
 Organisation : Bhabha Atomic Research Centre, Bombay-400085.  
 Project Category : Applied (Laboratory scale extrusion cooker with heaters and control arrangement was designed and fabricated in FIPLY).  
 Cost : Approx. Rs. 10 to 15 thousand.  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Bongirwar, D.R. and others.  
 Description : See papers published.  
 Report(s) : -  
 Papers Published : 1. Development of high protein ready to eat foods from defatted groundnut and soyabean by extrusion cooking. Bongirwar, D.R., and others. Indian Food Packer, Vol.33, No.1, pp. 37-53, 1979.
- 208 Project Title : New product development with new bites and textures.  
 Organisation : Britannia Industries Ltd., Research and Development Division, Plot 112, Street 13, Marol MIDC, Andheri East, Bombay-400093.  
 Project Category : Applied.  
 Cost : -  
 Duration : Continuing.  
 Sponsor(s) : Company.  
 Investigator(s) : Krishnaswamy, S.V.; Bedekar, D.B.  
 Description : Two new products have been developed and one has been approved. This has been made possible with a study of functional properties of ingredients and their effect on product texture. Further work is in progress to apply these results to formulate other new products.  
 Report(s) : Report for company circulation only.  
 Papers Published : -
- 209 Project Title : Development of recipes for school lunch programme.  
 Organisation : Food Craft Institute, Shivajinagar, Pune -411005.  
 Project Category : Applied.  
 Cost : Rs. 2,000/-.  
 Duration : 1981-1983.  
 Sponsor(s) : Institute.  
 Investigator(s) : Gangolli, V.A. and others.  
 Description : Development of simple recipes with indigenous food commodities like horsegram, chickpea, ragi, moong, wheat and bajra is being carried out.  
 Report(s) : -  
 Papers Published : -
- 210 Project Title : Kuzhandai Amudhu.  
 Organisation : Sri Avinashilingam Home Science College for Women, Coimbatore-641011  
 Project Category : Applied.  
 Cost : Rs. 8,000/-.  
 Duration : April 1977-  
 Sponsor(s) : College.  
 Investigator(s) : Devadas, P.R. and others.  
 \*172
- 211 Project Title : Nutritional and biochemical studies on commercial infant milk foods and weaning foods.  
 Organisation : National Dairy Research Institute, Southern Regional Station, Audugodi, Bangalore.  
 Project Category : Applied.

- Cost : -  
 Duration : 1980-1981.  
 Sponsor(s) : ICAR  
 Investigator(s) : Kalpana, R; Rao, R.V.  
 Description : The project aims to study the dried milk food for their nutritional and biochemical qualities; to assess the changes/loss brought about due to processing and bacteriological quality and to evaluate the nutritional qualities by animal and infant feedings in selected areas.  
 Report(s) : -  
 Papers Published : -
- 212 Project Title : Formulation and evaluation of infant foods.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,32,570/-.  
 Duration : May 1976-March 1979.  
 Sponsor(s) : CSIR  
 Investigator(s) : Venkata Rao, S. and others.  
 Description : Three infant food formulations comprising respectively 22% protein (formula I), 11% protein (formula II) and 11% protein supplemented with methionine (formula III) were tried on 29 babies for 6 months in two hospitals, one at Mysore and the other at Hyderabad and the babies studied for weight gain, serum protein content, albumin content and blood haemoglobin. The formulations were also estimated for vitamin A, B1, B2, niacin, vitamin C and iron and it was found that they contained the above nutrient in adequate quantities for meeting the nutritional requirement of infants. Other studies included the excretion of urinary creatinine and hydroxyproline at intervals after feeding, and the immunological studies of the babies.  
 Report(s) : Final.  
 Papers Published : 1. Ramanathan, G. and Venkata Rao, S. Weaning and new foods for infants Presented at Symposium on Food Processing for Developing Countries, Wellington, New Zealand, February 1978 .
- \*187
- 213 Project Title : Process development studies on the production of weaning food based on germinated ragi and green gram.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Process Design and Development Discipline.  
 Project Category : Applied.  
 Cost : Rs. 2,50,000/-.  
 Duration : August 1980-December 1981.  
 Sponsor(s) : Institute.  
 Investigator(s) : Laxminarayana Rao, K. and others.  
 Description : Malting conditions for ragi and green gram to obtain good quality malt were verified and data on the effect of bed depth, temperature and humidity on malting were collected using a batch malting box. Drying and kilning data were also collected. A combined striping, germinating, drying and kilning unit (80 kg ragi or 60 kg green gram capacity/batch) was designed and fabricated. Data for designing a continuous dryer-cum-kiln for green gram malt were also collected. A project engineering report for the manufacture of 900 tonnes/year of malted food was prepared for an industry.  
 Report(s) : -  
 Papers Published : -
- \*\*214,215



- 214 Project Title : Immunological surveillance of babies fed infant formulations and feeding trials on a weaning food based as ragi and bengal gram.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition Discipline.
- Project Category : Applied.
- Cost : Rs. 6,97,000/-.
- Duration : April 1979-March 1982
- Sponsor(s) : Institute.
- Investigator(s) : Venkat Rao, S. and others.
- Description : Immunological studies on blood and studies on urinary creatinine and hydroxyproline contents were carried out in 2 groups of infants fed a control formula containing 22% protein and a modified formula containing 11% protein. Immunological status did not differ significantly between the groups. In feeding trials with weaning food based ragi and green gram, it was found that weight gain, blood composition (protein, albumin and haemoglobin), and N and P retention were similar to those obtained by a proprietary brand of weaning food. Ca retention was, however, lower in babies fed ragi weaning food.
- Report(s) : -
- Papers Published : -
- \*\*213,215
- 215 Project Title : Essential fatty acid status of infants, feeding trials on a weaning food based on ragi and soyabean and development of special diets for infants with lactose intolerance and disorders of aminoacid metabolism.
- Organisation : Central Food Technological Research Institute, Mysore-570013;
- Project Category : Applied.
- Cost : Rs. 7,71,000/-.
- Duration : April 1982-March 1985.
- Sponsor(s) : Institute.
- Investigator(s) : Venkat Rao, S. and others.
- Description : Conditions were standardised for the production in pilot plant scale of an infant formula containing 12% milk protein and 20% fat in which half the fat was derived from vegetable oil. A weaning food based on 75% malted ragi and 25% green gram was prepared. Four babies ranging in age from 6-12 months tolerated this product well, when fed for a period of one month. Attempts are being made to develop a low-phenylalanine formula and a lactose-free formula for treatment of babies suffering from phenylketoxuria and lactose intolerance.
- Report(s) : -
- Papers Published : -
- \*\*213,214
- 216 Project Title : Soya bean based products.
- Organisation : Cadbury India Limited, Cadbury House, Bhulabhai Desai Road, Bombay-400 026.
- Project Category : Applied.
- Cost : Rs. 25,00,000/-.
- Duration : June 1978-December 1980.
- Sponsor(s) : Company.
- Investigator(s) : Shenoy, R.D.; Morde, C.E.
- ‡174
- 217 Project Title : Utilisation of rare fruits and flowers.
- Organisation : Government Fruit Preservation and Canning Institute, 18-B Ashok Marg, Lucknow-226 001.

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| Project Category | : Applied  |
| Cost             | : -  |
| Duration         | : 1972-  |
| Sponsor(s)       | : Government of Uttar Pradesh, Horticulture and Fruit Utilisation Directorate. |
| Investigator(s)  | : Mehta, C.L.; Tomar, M.C.   |
| *176             |  |
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|-------------------|---|
| 218 Project Title | : Preparation of convenience foods; composite flours and enrichment methods.        |
| Organisation      | : University of Agricultural Sciences; Bangalore-560024; Home Economics Department. |
| Project Category  | : Applied.  |
| Cost              | : Rs. 5,000/- year.   |
| Duration          | : 1977-1979.  |
| Sponsor(s)        | : University.   |
| Investigator(s)   | : Vaidehi, M.P.   |
| *178              |   |
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- |                   |   |
|-------------------|---|
| 219 Project Title | : Evaluation of low-cost balanced diets.  |
| Organisation      | : Government of India; Ministry of Agriculture and Irrigation; Department of Food; Food and Nutrition Board, Krishibhavan, New Delhi-110 001. |
| Project Category  | : Applied.  |
| Cost              | : Rs. 80,000/year.  |
| Duration          | : December 1973-  |
| Sponsor(s)        | : Food and Nutrition Board.   |
| Investigator(s)   | : Banerjee, S.N.  |
| *179              |   |
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|-------------------|--|
| 220 Project Title | : High protein low cost snack foods.   |
| Organisation      | : Britannia Biscuit Company Limited, 'Nirmal', 20th Floor, Nariman Point, Bombay-400021. |
| Project Category  | : Applied.   |
| Cost              | : -  |
| Duration          | : March 1978-February 1979.  |
| Sponsor(s)        | : Company.   |
| Investigator(s)   | : Krishnaswamy, S.V. and others.   |
| *182              |  |
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- |                   |   |
|-------------------|---|
| 221 Project Title | : Emergency foods from wild flora of Himalayan region.  |
| Organisation      | : Regional Research Laboratory, Canal Road, Jammu Tawi-180001.  |
| Project Category  | : Applied and Survey.   |
| Cost              | : Rs. 62,500/-.   |
| Duration          | : July 1976-December 1982.  |
| Sponsor(s)        | : CSIR  |
| Investigator(s)   | : Bhatia, A.K. and others.  |
| Description       | : The project aims at identification and analysis of the wild roots, tubers, fruits and flowers, etc. of the Himalaya region, consumed by the tribals, and development of emergency foods from them. Surveys are being carried out in the Sunderban region of the Himalayas to collect information about the wild food consumed by the tribals. Techniques have been standardised for commercial production and preservation of 'chhang', a fermented beverage of Himalayan folk. Further surveys are envisaged to be carried out in other parts of Himalayas. There is also a plan for setting up of a plant at Leh for the industrial production of 'chhang'. |
| Report(s)         | : -   |



- Papers Published : 1. Atal, C.K. and others. Search of emergency foods through wild flora of Jammu and Kashmir State: Sunderbani region. I. Indian Forester. 106(3); 1980; 211
2. Bhatia, A.K. and others. Chhang, the fermented beverage of Himalayan folk. Indian Food Packer. 31(4); 1977; 32-

\*184

- 222 Project Title : Tea enricher project (milk substitute).  
 Organisation : Government of India; Ministry of Agriculture and Irrigation; Department of Food; Food and Nutrition Board, Krishi Bhavan, New Delhi-110001.  
 Project Category : Applied.  
 Cost : Rs. 43,26,000/-.  
 Duration : June 1976-.  
 Sponsor(s) : Food and Nutrition Board.  
 Investigator(s) : Aneja, R.P. (National Dairy Development Board, Anand).

\*185

- 223 Project Title : Balamul weaning food.  
 Organisation : Government of India; Ministry of Agriculture and Irrigation; Krishibhavan, New Delhi-110001; Department of Food; Food and Nutrition Board.  
 Project Category : Applied.  
 Cost : Rs. 1,80, 0,000/-.  
 Duration : 1970-.  
 Sponsor(s) : Food and Nutrition Board.  
 Investigator(s) : Dalaya, H.M.; Shah, V.H. (Kaira District Milk Producers Union Ltd., Anand).

\*191

- 224 Project Title : Production of Balahar.  
 Organisation : Government of India; Ministry of Agriculture and Irrigation; Department of Food; Food and Nutrition Board, Krishibhavan, New Delhi-110001.  
 Project Category : Applied.  
 Cost : Rs. 250,00,000/- per year.  
 Duration : 1966-.  
 Sponsor(s) : Food and Nutrition Board.  
 Investigator(s) : Food Corporation of India.

\*192

- 225 Project Title : Studies on the development of spray dried malted milk food.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Salooja, M.K.; Balachandran, R.  
 Description : A product with desired quality has been developed and evaluated.  
 Report(s) : -  
 Papers Published : -

- 226 Project Title : Leaf protein research in collaboration with U.A.S.; Bangalore.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Protein Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,24,000/- (CFTRI contribution Rs. 51,790/-).  
 Duration : April 1979-March 1981.  
 Sponsor(s) : Central Food Technological Research Institute, and University of Agricultural Sciences, Bangalore.

- Investigator(s) : Narendra Singh and others.  
 Description : Feeding experiments were conducted on poultry and dairy cattle with broilers, the main findings were that lucerne LPC can replace groundnut cake at 65% level, though 45-50% gave better gains. In the case of cattle a replacement of fresh fodder maize with lucerne fibrous residue gave better result at 50% than at 100%. More detailed animal studies are to be conducted to establish the technical and economic feasibility of leaf protein approach to animal feeds.
- Report(s) : Final.  
 Papers Published : -
- 227 Project Title : Studies on bland and colourless lucerne leaf protein and investigations on tecoma leaf protein.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Protein Technology Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 1,23,000/-.  
 Duration : April 1979-March 1981.  
 Sponsor(s) : CSIR  
 Investigator(s) : Narendra Singh and others.  
 Description : Bland and colour less lucerne cytoplasmic leaf protein concentrate (LPC) was prepared by different fractional procedures and solvent extraction techniques. In studies on the effect of processing on pigments, it was found that low pH and exposure to light during storage of acetone extracted LPC accelerated pigment losses. SO<sub>2</sub>, was effective in checking pigment losses. Composition, nutritional and functional properties as also gel filtration and electrophoretic patterns of different preparations were also studied. Acid precipitated material was found better for solvent extraction of pigment. The solubility and other protein characteristics were improved by post-chloroplast separations and handling at low temperature (4 C) instead of room temperature. The fractionated cytoplasmic leaf proteins exhibited differences in composition, nutritional value and functional properties. Data was also collected on Techoma leaf protein regarding extractability from leaves under different conditions.
- Report(s) : Final.  
 Papers Published : 1. Gurumukh Singh and Narendra Singh. Fractionation of leaf proteins of lucerne (Medicago sativa) by organic solvents. Presented at Second Indian Convention of Food Scientists, and Technologists, CFTRI, Mysore, February 1981.  
 2. Gurumukh Singh and Narendra Singh. Fractionation of leaf proteins of lucerne (Medicago sativa) under low pH, low temperature. J. Food Sci. Technol. 17; 1980; 280 .  
 3. Gurumukh Singh and Narendra Singh. Pigments and nitrogen in precipitated leaf proteins from lucerne. Presented at Annual Meeting of Society of Biological Chemists (India), Bangalore, December 1980 .
- 228 Project Title : Miltone project.  
 Organisation : Government of India; Ministry of Agriculture and Irrigation; Department of Food; Food and Nutrition Board, Krishibhavan, New Delhi-110001.  
 Project Category : Exploratory.  
 Cost : Rs. 80,000/- per year.  
 Duration : 1977- .  
 Sponsor(s) : Food and Nutrition Board.  
 Investigator(s) : Banerjee, S.N.



## Food Grains and Seed Material

- 229 Project Title : Coordinated scheme for studies on harvest and post-harvest technology.
- Organisation : Punjab Agricultural University, Ludhiana; College of Agricultural Engineering; Department of Processing and Agricultural Structures.
- Project Category : Applied.
- Cost : Rs. 3,00,540 per year.
- Duration : 1972-1983
- Sponsor(s) : ICAR/Punjab Government.
- Investigator(s) : Kashyap, M.M. and others.
- Description : The project intends to determine the optimum stage of harvesting of different crops in retention to their post-harvest qualities such as milling and cooking; to increase the efficiency of post-harvest handling machines for major cereal grains including seeds; to generate more employment in the rural areas by planning for small agro-processing equipment so that the farmers can produce value added products; utilization of crop wastes for bringing more economic returns to the farmers in solving energy crises; to develop equipment using alternate sources of energy for drying and preserving of surplus and perishable commodities of the farmers.
- Report(s) : Annual Report.
- Papers Published : 1. Bhupinder Kaur and Singh, Y. Effect of dehydration and storage of cauliflower (*Brassica oleracea* var. *Botryta*) on the physical characteristics. *Indian Fd. Packr.* 35(1); 1981; 23-26.
2. Bahga, G.S. and others. Effect of spray-cooling and wallowing on blood composition in buffaloes during summer. *Indian J. Dairy Sci.* 33(3); 1980; 294-298.
- 230 Project Title : Post-harvest technology of food crops.
- Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani-431 402; Department of Food Science and Technology.
- Project Category : Applied.
- Cost : Rs. 10,00,000/-.
- Duration : September 1980-September 1985.
- Sponsor(s) : Government of Maharashtra.
- Investigator(s) : Jadhav, S.J. and others.
- \*\*231, 232, 233
- 231 Project Title : Post-harvest technology of food crops: Linseed protein isolates and concentrates - preparation and study of functional properties.
- Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani-431 402; Department of Food Science and Technology
- Project Category : Applied.
- Cost : Rs. 10,00,000/-.
- Duration : September 1980-September 1985.
- Sponsor(s) : Government of Maharashtra.
- Investigator(s) : Jadhav, S.J. and others.
- Description : The project is concerned with preparation of linseed protein isolates and concentrates, determination of optimum conditions for isolation and evaluation of their functional properties. At present, effect of extraction time, pH, flour extractant ratio and the type of extractant on the protein yield is being studied.

- Report(s) : Annual.  
Papers Published : -
- 232 Project Title : Post-harvest technology of food crops: Improvement of nutritional quality of potatoes particularly vitamin C.  
Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani-431 402; Department of Food Science and Technology.  
Project Category : Applied.  
Cost : Rs. 10,00,000/-.  
Duration : September 1980-September 1985.  
Sponsor(s) : Government of Maharashtra.  
Investigator(s) : Jadhav, S.J. and others.  
Description : Studies are concerned with developing techniques to improve vitamin C content of potatoes. Currently, work is being done to stimulate vitamin C synthesis by mechanical injury such as slicing, cutting, puncturing, etc.  
Report(s) : -  
Papers Published : -
- 233 Project Title : Post-harvest technology of food crops: Improvement in cooking and nutritional quality of different types of beans.  
Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani-431 402; Department of Food Science and Technology.  
Project Category : Applied.  
Cost : Rs. 10,00,000/-.  
Duration : September 1980-September 1985.  
Sponsor(s) : Government of Maharashtra.  
Investigator(s) : Jadhav, S.J. and others.  
Description : Studies are being conducted on improving cooking and nutritional quality of different types of beans by physico-chemical treatments.  
Report(s) : -  
Papers Published : -
- 234 Project Title : Histochemical investigations on grains in relation to their technological properties and to assist the breeder in varietal improvement.  
Organisation : Central Food Technological Research Institute, Mysore-570013; Rice and Pulse Technology Discipline.  
Project Category : Fundamental and applied.  
Cost : Rs. 6,25,500/-.  
Duration : April 1981-March 1984.  
Sponsor(s) : Institute.  
Investigator(s) : Srinivas, T. and others.  
Description : The studies included effect of groove depth on milling quality, varietal differences in bran layer thickness and germ content, association of higher nutrition with grain chalkiness, physiological influence on the development on white belly and histological differences associated with grain shedding in Echinochloa.  
Report(s) : -  
Papers Published : 1. Bhashyam, M.K. and Srinivas, T.H. A simple and rapid histological technique to predict degree of shedding in rice varieties. Rice. J. 85(2); 1982; 18 .  
2. Bhashyam, M.K. and Srinivas, T. Studies on the association of white core with grain dimension in rice. J. Food Sci. Technol. 18; 1981; 214 .



- 235 Project Title : Increasing the storage life of grains.  
 Organisation : Food Craft Institute, Shivaji Nagar, Pune- 411005.  
 Project Category : Applied.  
 Cost : Rs. 2,500/-.  
 Duration : 1982-1985.  
 Sponsor(s) : Institute.  
 Investigator(s) : Gangolli, V.A. and others.  
 Description : The project intends to develop different types of bins and natural grain preservation to increase the storage life of grains, so that grains may be purchased during harvest season when it is cheap and stored for the whole year.  
 Report(s) : -  
 Papers Published : -
- 236 Project Title : Evaluation of existing post-harvest technique in tribal and less developed areas.  
 Organisation : Punjabrao Krishi Vidyapeeth, Akola-444 104; Harvest and Post-harvest Scheme.  
 Project Category : Applied.  
 Cost : Rs. 95,812/-.  
 Duration : September 1972-March 1979.  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Muzumdar, G.K. and others.  
 \*201
- 237 Project Title : Studies on the effect of insecticides and fumigants on viability of seeds.  
 Organisation : Indian Grain Storage Institute, Hapur-245 101.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977-1979.  
 Sponsor(s) : Government of India; Ministry of Agriculture and Irrigation; Department of Food, Krishi Bhavan, New Delhi-110 001.  
 \*198
- 238 Project Title : Study of grain losses during threshing.  
 Organisation : University of Agricultural Sciences; G.K.V.K. Campus, Bangalore-560 065; Agricultural Engineering Department.  
 Project Category : Applied.  
 Cost : Rs. 1,60,000/-.  
 Duration : 1978-  
 Sponsor(s) : University.  
 \*202
- 239 Project Title : Improvement of prevalent open sundrying process to reduce the initial losses.  
 Organisation : Punjabrao Krishi Vidyapeeth, Akola-444 104; Harvest and Post-harvest Technology Scheme.  
 Project Category : Applied.  
 Cost : Rs. 73,500/-.  
 Duration : June 1975-March 1979.  
 Sponsor(s) : International Development Research Centre, Canada; and Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Hiwase, S.S. and others.  
 \*205
- 240 Project Title : Use of solar energy and agricultural waste for drying the crops like jowar, groundnut and millets in comparison with mechanical dryer.

- Organisation : Punjabrao Krishi Vidyapeeth, Akola-444 104; Harvest and Post-Harvest Technology Scheme.  
 Project Category : Applied.  
 Cost : Rs. 73,500/-.  
 Duration : June 1975-March 1979.  
 Sponsor(s) : International Development Research Centre, Canada; and Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Hawase, S.S. and others.  
 \*296
- 241 Project Title : Use of agricultural waste as heat source for drying.  
 Organisation : Punjabrao Krishi Vidyapeeth, Akola-444 104; Harvest and Post-Harvest Technology Scheme.  
 Project Category : Applied.  
 Cost : Rs. 95,812/-.  
 Duration : September 1972-March 1979.  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Muzumder, G.K. and others.  
 \*207
- 242 Project Title : Studies on nutritional quality characteristics of food crops in Madhya Pradesh.  
 Organisation : Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur-482 004; Crop Quality and Food Science Section.  
 Project Category : Applied.  
 Cost : Rs. 1,200/- per year.  
 Duration : June 1972-.  
 Sponsor(s) : Government of Madhya Pradesh  
 Investigator(s) : Gupta, A.K. and others.  
 \*211
- 243 Project Title : Field survey of stored grain pests.  
 Organisation : Orissa University of Agriculture and Technology: College of Agriculture; Bhubaneswar-751 003; Entomology Department.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1975-1980.  
 Sponsor(s) : University.  
 Investigator(s) : Rout, G.; Jacob, T.J.  
 \*214
- 244 Project Title : Studies on stored grain pests and their control.  
 Organisation : Orissa University of Agriculture and Technology; College of Agriculture, Bhubaneswar-751 003; Entomology Department.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1975-1980.  
 Sponsor(s) : University.  
 Investigator(s) : Rout, G., Jacob, T.J.  
 \*217
- 245 Project Title : Safe storage of home made processed foods and their evaluation for human consumption.  
 Organisation : University of Udaipur; Udaipur-313001, Rajasthan.  
 Project Category : Survey and applied.  
 Cost : Rs. 1,27,540/-.  
 Duration : 1981-1984.  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Chandrasekhar, K.N.; Kavadia, V.S.  
 Description : The project aims to survey the existing storage methods for home



made processed foods in Rajasthan to study the recipes and methods to improve them; to examine the effectiveness of various fumigants and protectants in protecting these foods after preparation and to assess their residues in them; and to conduct sensory and nutritional evaluations of treated home-made processed foods.

Report(s) : -  
Papers Published : -

- 246 Project Title : Pesticide residue analysis in stored food grains.  
Organisation : Indian Grain Storage Institute, Hapur-245 101.  
Project Category : Applied.  
Cost : -  
Duration : 1977-.  
Sponsor(s) : Government of India, Ministry of Agriculture and Irrigation, Department of Food, Krishi Bhavan, New Delhi - 110001.  
Investigator(s) : Doharey, R.B.; Ashok Kumar.  
\*219
- 247 Project Title ; Characteristics of puffed cereals and legumes.  
Organisation : University of Bombay; Chemical Technology Department; Matunga Road, Bombay-400 019.  
Project Category : Applied.  
Cost : Rs. 7,000 per year.  
Duration : -  
Sponsor(s) : University Grants Commission, New Delhi.  
Investigator(s) : Lal, P.P.; Kulkarni, P.R.  
\*224
- 248 Project Title : Food functionality of local cereals grains.  
Organisation : Institute of Catering Technology and Applied Nutrition, Calcutta-700 014.  
Project Category : Exploratory.  
Cost : -  
Duration : 1975-1980  
Sponsor(s) : Institute.  
Investigator(s) : Chakravarti, B.K.  
\*225
- 249 Project Title : Studies on the keeping quality of cereal products.  
Organisation : Indian Grain Storage Institute, Hapur-245 101.  
Project Category : Applied.  
Cost : -  
Duration : 1978-1979.  
Sponsor(s) : Government of India, Ministry of Agriculture and Irrigation, Department of Food, Krishi Bhavan, New Delhi - 110 001.  
Investigator(s) : Doharey, R.B.; Subhash Gupta.  
\*226-
- 250 Project Title : Nutritional evaluation of newly evolved varieties of cereals, pulses, vegetable and fruit crops.  
Organisation : Haryana Agricultural University, Hissar-125 004; Chemistry and Biochemistry Department.  
Project Category : Applied.  
Cost : -  
Duration : 1975-.  
Sponsor(s) : University.  
Investigator(s) : Wagle, D.S. and others.  
\*227

- 251 Project Title : Biochemical changes in stored cereal grains in presence of fumigants.  
 Organisation : Calcutta University; Biochemistry Department; Food Technology Laboratory, 35 B.C. Road, Calcutta-700 019.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 20,000/-.  
 Duration : March 1976-March 1981.  
 Sponsor(s) : Government of West Bengal, State Planning Board.  
 Investigator(s) : Ghosh, J.J. and others.  
 \*228
- 252 Project Title : Nutritive value of cooked food and losses of different nutrients in cereals and pulses subjected to different heat treatments in cooking.  
 Organisation : Andhra Pradesh Agricultural University; College of Home Science, Saifabad, Hyderabad-500 004.  
 Project Category : Applied and survey.  
 Cost : Rs. 1,25,000/-.  
 Duration : February 1978-February 1980.  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Pushpamma, P.; Geervani, P.  
 \*229
- 253 Project Title : In vitro digestability of cereals and legumes.  
 Organisation : Nagpur University, Laxminarayan Institute of Technology, Nagpur; Food Technology Section.  
 Project Category : Fundamental and applied.  
 Cost : -  
 Duration : 1975 onwards.  
 Sponsor(s) : Rao, B.Y. and others.  
 Description : The project investigates into the various ways of processing of legumes and cereals prior to consumption and the determination of in vitro digestibility with proteases and amylases, to predict the actual food value to the consumer. The effect of germination, dry heat treatment, moist heat treatment and autoclaving on the protein and carbohydrate digestability are being investigated. The products formed during processing are being evaluated as activators and or inhibitors to the digestive enzymes.  
 Report(s) : -  
 Papers Published : -
- 254 Project Title : Studies on phytin phosphorous in rice and wheat.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad-500 007.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : Nearly 70-75% of total phosphorous was present as phytate in whole wheat and bran rice. Milling of whole wheat to varying extraction resulted in a progressive decrease both in total phosphorous content as phytate (expressed as % total P) as percent extraction decreased. Even in 70% extracted wheat flour, phytate was present to the extent of 20% of total P. The phytate content of brown rice (derived from paddy as it is) or after parboiling, was similar (75%). The effect of milling total phytin phosphorous was also similar. However, in parboiled milled rice, the total phosphorus was somewhat higher than in raw milled rice; the phytate expressed as % of total P was thus less in parboiled milled rice.



- Report(s) : Annual report.
- Papers Published : 1. Deosthale, Y.G. and others. Effect of milling on mineral and trace element composition of raw and parboiled rice. J. Sci. Food Agric. 30; 1979; 40,
- 255 Project Title : Chemical, biochemical and nutritional aspects of food carbohydrates such as cow pea; field bean and ragi.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition Discipline.
- Project Category : Fundamental and applied.
- Cost : Rs. 4,11,230/-.
- Duration : April 1979-March 1982.
- Sponsor(s) : Institute.
- Investigator(s) : Shurpalekar, K. and others.
- Description : Various carbohydrate fractions of the above grains, like alcohol-soluble sugars, water-soluble gums, starch, pectin, hemicellulose and cellulose were studied. Field bean-cellulose reduced food transit time and non flatulent. However, free sugars, starch and protein of field bean induced flatus to different degrees. Field bean prevented rise in cholesterol in hypercholesterolemic diets of rats, the effect being comparable to that of pectin. Field bean and some of its carbohydrate fractions affected absorption of N and Ca. Amylolytic susceptibility studies using purified glucoamylase and  $\alpha$ -amylases of field bean and varagu (Paspalum scorbiculatum) starch granules revealed characteristic degradation patterns as seen by electron microscope. Black gram and cowpea dhals, extracted with 10% TCA, approved Viscogenic-mucilaginous polysaccharides composed of major amounts of arabinose and galactose followed by galacturonic acid, rhamnose and glucose. On complete fractionation, the blackgram mucilage was homogenous corroborating with electrophoretic results. Starch and nonstarchy carbohydrates of Samai, Sanwa and Pani varagu were isolated (yield 56-65%) and partially characterised. They exhibited properties similar to those of legume starches. Rice husk incorporated in diet (8%) showed better growth rate in rats, the beneficial effects being reflected in serum protein, body and liver N and N balance. Deproteinised ragi husk (10,15 and 20% levels) showed better growth rate than with similar levels of cellulose.
- Report(s) : -
- Papers Published : 1. Muralikrishna and others. Carbohydrate make up of minor millets. Die Starke 12; 1982; 397 .
2. Paramahans, S.V. and others. Studies on varagu starch. Die Starke. 32; 1980; 109).
3. Paramahans, S.V. and Tharanathan, R.N. Carbohydrate composition of the millet varagu. Die Starke.
4. Paramahans, S.V. and Tharanathan, R.N. Carbohydrates of field bean (Dolichos lab lab). Cereal Chem. 59; 1982; 430
5. Paramahans, S.V. and Tharanathan, R.N. Primary structure of two arabinogalactans from the water soluble polysaccharides of field bean (Dolichos lab lab) hulls. Carbohydrate Res. 104; 1982; 341 .
6. Paramahans, S.V. and Tharanathan, R.N. Scanning electron microscopy of enzyme digested varagu starch granules. Die Starke. 34; 1982; 73 .
7. Paramahans, S.V. and Tharanathan, R.N. Structural features of two amyloids from the hemicellulosic fraction of field bean (Dolichos lab lab) hulls. Carbohydrate Res. 104; 1982; 103

8. Paramahans, S.V. and Tharanathan, R.N. Structural features of two pectic fractions from field bean (*Dolichos lab lab*) hulls. Carbohydrate Res. 106; 1982; 251
9. Tharanathan, R.N. and others. Amylolytic susceptibility of native groundnut and ragi starch granules as viewed from scanning electron microscopy. Die Starke 32; 1980; 158

- 256 Project Title : Studies on the production of zearalenone in cereals.  
 Organisation : Tamil Nadu Agricultural University, Coimbatore-641 003; Department of Food Technology.  
 Project Category : Applied.  
 Cost : Rs. 2,500/-.  
 Duration : June 1981-June 1984.  
 Sponsor (s) : University.  
 Investigator (s) : Neelakantan, S.  
 Description : The conditions under which the oestrogenic mycotoxin, zearalenone, produced by *Fusarium* sp. in cereal grains will be studied. The results will help not only in designing proper post harvest facilities but also in creating awareness among warehousing staff regarding the hazards of fungus growth and its prevention.  
 Report (s) : -  
 Papers Published : -
- 257 Project Title : Puffing quality of cereals and food legumes.  
 Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani-431 402; Department of Food Science and Technology.  
 Project Category : Applied.  
 Cost : Rs. 10,000/-.  
 Duration : August 1981-August 1983.  
 Sponsor (s) : University.  
 Investigator (s) : Dev, D.K.  
 Description : The project is concerned with: (a) study of puffing quality of jowar and chickpea (b) study varietal differences, if any, in the puffing quality and (c) improvement of puffing quality using physicochemical treatment.  
 Report (s) : -  
 Papers Published : -
- 258 Project Title : Energy conservation in food processing: I. Energy consumption and possibilities of energy saving in cooking grain at household level.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Rice and Pulse Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,23,400/-.  
 Duration : July 1982-July 1984  
 Sponsor (s) : Institute.  
 Investigator (s) : Desikachar, H.S.R. and others.  
 Description : Energy required for cooking raw rice, parboiled rice, humped parboiled rice, pressure parboiled rice and rice flakes has been measured. The relative energy requirements for cooking 1 kg of each were 0.7 Kw, 0.75 KW, 0.4 KW, 0.85 KW and 0.4KW respectively. Substantial energy was required for raising the water to boil  
 Report (s) : -  
 Papers Published : -



- 259 Project Title : Studies on the food grain starches.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Rice and Pulse Technology Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 4,22,000/-.  
 Duration : April 1980-March 1983.  
 Sponsor(s) : Institute.  
 Investigator(s) : Bhattacharya, K.R.; Zakiuddin Ali, S.Z.  
 Description : Various methods of isolation of starch from waxy and non-waxy rice, jowar and maize, hard and soft wheat, bengal gram and tapioca, were compared. It was found that isolation after dilute alkaline steeping gave as good an undegraded starch as water steeping followed by deproteinisation. Swelling and solubility data at approximately 75 C gave a good indication of any degradation. Fungus and insect infested grains yielded starch of slight to moderate degradation. Further studies are in process under controlled conditions of infestation. Other functionally significant properties of the starches will also be studied.  
 Report(s) : -  
 Papers Published : -
- 260 Project Title : Studies on the nutritional quality characteristics of food crops of Madhya Pradesh.  
 Organisation : Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur-482 004; Faculty of Agriculture; Department of Food Science.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 60,000 per year.  
 Duration : June 1972 continuing.  
 Sponsor(s) : Government of Madhya Pradesh.  
 Investigator(s) : Gupta, A.K.; Rajpur, L.P.  
 Description : The project was started with the primary aim of improving crop qualities of nutritional and economic significance. This necessitated research programs aimed at developing standardised methodologies for use in quality improvement work. Earlier work involved standardisation of analytical methods for determining physical, chemical and sensory characteristics of promising varieties of crops such as wheat, triticale, pulses, oil-seeds and millets. The effect of variety, soil fertility, environment and location on the nutritional quality of these crops were also studied. Presently, efforts are being successfully made to tackle the crop improvement problems by using the methodologies developed. It is also envisaged to develop physical facilities for undertaking biological evaluation work on regular basis.  
 Report(s) : Annual report of crop quality laboratory.  
 Papers Published : -  
 \*\*386,394
- 261 Project Title : Scheme for testing the nutritive value of new varieties of food crops.  
 Organisation : Andhra Pradesh Agricultural University, College of Home Science, Hyderabad - 500 004.  
 Project Category : Applied.  
 Cost : Rs. 2,25,000/-.  
 Duration : January 1979-March 1983.  
 Sponsor(s) : Government of Andhra Pradesh.  
 Investigator(s) : Pushpamma, P.; Geervani, P.  
 Description : The project is primarily concerned with evaluation of nutrient composition of newly varieties of food crops of A.P. as and when they are released. So far, a number of varieties of cereals,

milletts, legumes and tubers have been tested for nutritional, milling and cooking characteristics.

Report(s)  
Papers Published

262 Project Title : Studies on food carbohydrates of cereals and legumes.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition Discipline.  
 Project Category : Applied.  
 Cost : Rs. 9,34,240/-.  
 Duration : April 1982-March 1985.  
 Sponsor(s) : Institute.  
 Investigator(s) : Kanta Shurpalekar, S. and others.  
 Description : From black gram mucilage, four different oligosaccharides and three pectic fractions were isolated mucilage was extracted from cowpea, linseed and okra and structural studies on these polysaccharides were undertaken. Foam stabilising property of cowpea mucilage was comparable to that of guar gum and gelatinized starch but was only half as efficient as blackgram mucilage. Thermal decrease in the viscosity of linseed mucilage was found to be reversible.

Report(s) : -  
 Papers Published : -

263 Project Title : Studies on physical and other engineering properties of food grains.  
 Organisation : Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal-462 010.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979  
 Sponsor(s) : ICAR  
 Investigator(s) : Srivastava, P.K. and others.  
 Description : Physical properties of various food commodities like rice, wheat, maize, sorghum, pigeon pea, soybean and groundnut were compiled. These properties which include dimensions, density, porosity, etc. vary with variety, moisture and temperature. Suitable devices for determination of angle of repose and coefficient of friction were designed and fabricated. In studies on sorghum to develop suitable technology and equipment for pearling and milling of sorghum, basic engineering properties like hectolitre weight, true density, sphericity, equivalent diameter and hardness of four varieties of sorghum were determined. Also determined were the hygroscopic properties of vegetable seeds.

Report(s) : -  
 Papers Published : -

264 Project Title : Nutritive value of grain chenopodium and grain amaranth.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad-500 007.  
 Project Category : Fundamental.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : These 'pseudo cereals' are cultivated in parts of Himachal Pradesh for human consumption. Their nutrient compositions were therefore determined. The results showed that these grains contained relatively higher amounts of protein (14.0%),



total lipid (5.4-7.3%) and Ca (225-300 mg/100 g) than the common cereals. The brown variety of amaranth had almost twice the amount of iron as the white variety. It was also richer in all the trace elements. These data indicated that these 'pseudo cereals' might have considerable potential as foods of high nutritive value.

Report(s) : Annual.  
Papers Published : -

### Paddy and Rice

- 265 Project Title : Drying studies of paddy.  
Organisation : Tamil Nadu Agricultural University; College of Agricultural Engineering, Coimbatore-641 003.  
Project Category : Applied.  
Cost : -  
Duration : 1972-  
Sponsor(s) : University.  
Investigator(s) : Narayanan, K.T.; Doraiswamy, G.  
\*237
- 266 Project Title : Field level testing and operating of improved paddy processing at the village level.  
Organisation : Central Food Technological Research Institute, Mysore-570013; Rice and Pulse Technology Discipline.  
Project Category : Applied.  
Cost : Rs. 13,41,000/-  
Duration : April 1978-December 1980.  
Sponsor(s) : CFTRI and University of Agricultural Sciences, Bangalore.  
Investigator(s) : Desikachar, H.S.R. and others.  
Description : Various improved methods for the processing of newer varieties of paddy at the village level were developed, tested and demonstrated. They include sun drying after harvesting at the optimal stage, drying-cum-curing, and use of common salt. All the methods gave improved milling quality and reduced crack formation. Investigations were also conducted on varietal improvement for crack resistance by intra-varietal selection and hybridisation. The biochemical basis of crack resistance in the crack resistant varieties was studied. A histological scale was also computed to predict the shedding behaviour of the improved varieties. In studies conducted on chalkiness in relation to white belly, a correlation between grain breadth and occurrence of white core was demonstrated in 138 varieties. A genetic chalky variety was also established in one rice variety. Several commercial paddy varieties were also screened for puffing quality.  
Report(s) : Final  
Papers published : 1. Srinivas, T. and Mukunda, M.R. Reaching technology to the farmer. (Kurukshetra. 28; 1980; 16)  
2. Srinivas, T. and Mukunda, M.R. Improved method of harvesting paddy. (Ahara Vignana. 25; 1980; 2) (in Kannada)  
3. Srinivas, T. and Mukunda, M.R. Improved method of drying paddy (Ahara Vignana. 25; 1980; 3).  
\*\*267,268,269,270  
\*232
- 267 Project Title : Histochemical investigations on grains in relation to their technological properties and to assist the breeder in varietal improvement.

Organisation : Central Food Technological Research Institute, Mysore-570013;  
 Rice and Pulse Technology Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 2,56,000/-.  
 Duration : August 1981-March 1984.  
 Sponsor(s) : Institute.  
 Investigator(s) : Srinivas, T.; Bhashyam, M.K.  
 Description : In two varieties (B 199 and BT 193 C) there were varietal differences in the endosperm cells in regard to shape and thickness while thickness of pericarp and aleurone layers did not vary significantly. However, in both types the layers were thicker on the dorsal side (100-102 m). In all varieties starch (crack resistant and crack-susceptible) cell wall thickness varied with hemicellulose content which is directly related to crack resistance. It was also revealed that partial chalkiness of the grain caused higher susceptibility to cracking and breakage during milling, complex chalking giving higher resistance. Scanning electron microscopy was also carried out with puffed paddy and rice and it was shown that on puffing the cells lost their isodiametric shape and became round or oval. There was also alteration in spacing of cells. The studies also revealed in 21 varieties studied, the ventrilateral, centrilateral and dorsilateral grooves varied among them. Photovolt reflectance values of whiteness indicated that deeper the groove greater is the polishing requirement. With shallow groove varieties, milling breakage was significantly reduced. Nineteen varieties were studied for bran layer thickness and germ content and certain varieties were identified as sources of germ plasma for improving bran oil property. Similarly some were identified to retain scutellum at 6% polish. Other conclusions included that: chalkiness improved protein content; white belly grains had higher susceptibility to crack formation; and in high shedding types, the thickened cells rendering the grains susceptible to shedding.

Report(s) : -

- Papers Published :
1. Bhashyam, M.K. and Srinivas, T. Histochemical peculiarities of grain cracking in rice (*Oryza sativa*. L.). Presented at Second Indian Convention of Food Scientists and Technologists, CFTRI, Mysore, February 1981.
  2. Bhashyam, M.K. and Srinivas, T. Physiological and physical characteristics of white belly in rice. Presented at Ahara 82 - International Food Conference, Bangalore, May 1982.
  3. Bhashyam, M.K. and Srinivas, T. A simple and rapid histological technique to predict degree of shedding in rice.
  4. Bhashyam, M.K. and Srinivas, T. Studies on the association of white core with grain dimension in rice. *J. Food Sci. Technol.* 18; 1981; 214.
  5. Srinivas, T. and others. Development of a modified technique for inter-varietal selection for low crack susceptibility and low milling breakage in rice. *Indian J. Agric. Sci.* 51; 1981; 228.

\*\*266,270

268 Project Title : Relationship of breakage and yield of rice during milling to mill equipment and kernel quality.  
 Organisation : Central Food Technological Research Institute, Mysore-570013;  
 Rice and Pulse Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,07,400/-



Duration - : April 1978-March 1980.  
 Sponsor (s) : Institute.  
 Investigator (s) : Bhattacharya, K.R. and others.  
 Description : It was found that breakage arose only from kernel defect. The type of equipment, the grain type and the degree of milling only affected the proportion of these defective kernels that broke.

Report (s) : -

Papers Published : 1. Indudhara Swamy, Y.M. and Bhattacharya, K.R. Breakage of rice during milling. Effects of kernel defect and grain dimension. J. Food Proc. Eng. 3(1); 1979; 29.  
 2. Indudhara Swamy, Y.M. and Bhattacharya, K.R. Breakage of rice during milling. Comparison among different shells. J. Food Proc. Eng. 3(1); 1979; 43.  
 3. Indudhara Swamy, Y.M. and Bhattacharya, K.R. Breakage of rice during milling. Types of cracked and immature grains. J. Food Sci. 47; 1982; 564.  
 4. Indudhara Swamy, Y.M. and Bhattacharya, K.R. Breakage of rice during milling. Effect of kernel chalkiness. J. Food Sci. Technol. 19; 1982; 125.

\*\*266,267,269,270

269 Project Title : Studies on rice quality.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Rice and Pulse Technology Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 1,25,200/-.  
 Duration : April 1977-March 1980.  
 Sponsor (s) : Institute.  
 Investigator (s) : Bhattacharya, K.R. and others.  
 Description : Several Indian varieties of rice were studied to evaluate their qualities and classify them accordingly. Various parameters studied were textural properties of cooked rice, viscosity as affected by storage, size and shape. Simple methods were also developed for determination of water insoluble amylase, viscograph test and classification of rice based on size and shape.

Report (s) : Final

Papers Published : 1. Bhattacharya, K.R.. A note on alkali test of rice using a petri dish. Int. Rice Res. Newsletter 4(2); 1979; 4.  
 2. Bhattacharya, K.R. and others. Importance of insoluble amylose as a determinant of rice quality. J. Sci. Food Agric. 29; 1978; 359.  
 3. Bhattacharya, K.R. and others. Quality of Indian rice. J. Food Sci. Technol. 17; 1980; 189.  
 4. Bhattacharya, K.R. and others. Quality classification of rice. Int. Rice Res. Newsletter. 4(4); 1979; 7.  
 5. Bhattacharya, K.R. and others. Varietal differences in equilibrium moisture content of rice and effect of kernel chalkiness. J. Food Sci. Technol. 16(5); 1979; 214.  
 6. Bhattacharya and others. Quality profiles of rice: A tentative scheme for classification. J. Food Sci. 47; 1982; 564.  
 7. Bhattacharya, K.R. and Sowbhagya, C.M. On alkali degradation type of rice kernels. J. Sci. Food Agric. 31; 1980; 615.  
 8. Bhattacharya, K.R. and Sowbhagya, C.M. An abridged Brabender viscograph test. Lebensm. Wiss. Technol. 14; 1981; 79.  
 9. Deshpande, S.S. and Bhattacharya, K.R. On the texture of cooked rice. J. Text. Stud. 13; 1982; 31.

10. Indudhara Swamy, Y.M. and others. Changes in physico-chemical properties of rice with ageing. J. Sci. Food Agric. 9; 1978; 359.
11. Md. Shams-ud-din and Bhattacharya, K.R. On the meaning of degree of milling of rice. J. Food Technol. 13; 1978; 99.
12. Sowbhagaya, C.M. and Bhattacharya, K.R. Simplified determination of amylose in milled rice. Starch 31(5); 1979; 159.

\*\*266,267,268,270

270 Project Title : Study of varietal differences in rice properties and its influence on the quality of rice products.

Organisation : Central Food Technological Research Institute, Mysore-570013; Rice and Pulse Technology Discipline.

Project Category : Fundamental and applied.

Cost : Rs. 2,91,000/-.

Duration : April 1980-March 1983.

Sponsor(s) : CSIR

Investigator(s) : Bhattacharya, K.R. and others.

Description : Several varieties of rice were evaluated on the basis of total and water-insoluble amylose, alkali score, equilibrium moisture content upon soaking (EMC-S), viscograph type, protein content and chalkiness index. Statistical correlation between the above parameters revealed that EMC-S was predictable on the basis of amylose content, alkali score and chalkiness index. Protein content was not related to other quality characteristics. Gelatinisation temperature could be predicted from alkali score, water uptake ratio and soluble amylose ratio. Further work on quality of rice varieties is in progress. Viscosity studies showed that it increased slightly with severity of parboiling but markedly in roasted parboiled rice and in flaked rice. Viscosity, however, fell in roasted and then wetted rice. Varietal differences existed in slurry viscosity, the waxy varieties showing very high viscosity. A differential test of gelatinisation and retrogradation in parboiled rice was devised. The blue value ratio, gel consistency test and alkali degradation test appeared to give a true index of gelatinisation alone unaffected by retrogradation. In studies on the effect of fat on starch reassociation in parboiled rice, it was found that fall in sedimentation value on reassociation was not affected by fat. Samples are now being studied by X-ray diffractography. Studies were also made on pressure parboiling technique and it was noted that this technique at 20% moisture gave acceptable milling and cooking quality but with white belly. Large scale work is in progress. Large scale curing studies of new paddy by steaming and of new milled rice by external heating were also conducted and the results are awaited.

Report(s) : -

Papers Published : -

\*\*266,267,268,289

271 Project Title : Effect of forms of nitrogen and salinity on physico-chemical and biochemical qualities of rice.

Organisation : Central Rice Research Institute, Cuttack-753006, Orissa.

Project Category : Fundamental and applied.

Cost : Rs. 27,000/-.

Duration : 1981 onwards.

Sponsor(s) : ICAR

Investigator(s) : Dubey, R.S.



- Description : Identification of the superior genotypes of rice varieties and their resistance to salinity has been attempted.
- Report(s) : Annual report of CRRI.
- Papers Published : 1. Dubey, R.S. 1981. Effect of salinity on the activities of amylase, RNase and protease in rice endosperm during germination. Society of Biological Chemists (India). Nov.18 to 20,1981, p.147.
2. Dubey, R.S. 1981. Hydrolytic enzymes of rice seeds differing in salt tolerance. "Symposium on Plant Physiology and Biochemistry in 1980's" held at IARI, New Delhi, Nov.23 to 25, 1981, p.41.
3. Dubey, R.S. 1982. Biochemical changes in germinating rice seed under saline stress. Biochem. Pflanz. Physiol. (in press).
4. Dubey, R.S. 1982. Influence of salinity on metabolism of germinating rice seed: Salt tolerant cultivar CSR-1. Physiol. Plant. (communicated).
5. Dubey, R.S. 1982. Preparation and partial purification of Xanthomonas oryzae phytotoxin. Beitr. Biol. Pflanzen. (communicated).
6. Dubey, R.S. 1982. Changes in carbohydrates, protein and nucleic acid content of rice endosperm during germination under saline stress. Proceedings of 69th Session of Indian Science Congress. Part IV, p.65.
- 272 Project Title : Pressure parboiling of paddy.
- Organisation : Paddy Processing Research Centre, Tiruvarur-610 108.
- Project Category : Applied.
- Cost : -
- Duration : 1969-1979.
- Sponsor(s) : Centre.
- Investigator(s) : Subrahmanyam, V. and others.
- \*236
- 273 Project Title : Effect of long-term feeding of chromium treated parboiled rice.
- Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : ICMR
- Investigator(s) : -
- Description : It was reported earlier that feeding of chromium treated parboiled rice to rats for 3 months did not show any deleterious effect. The study of the diet (80 parts of parboiled rice, 10 parts of casein, 5 parts of groundnut oil, 4 parts of mineral mixture, 1 part of vitamin mixture and 0.1 part of choline chloride) was extended upto a period of one year with two groups of 24 each of 35 day old rats. Results showed no adverse effects on body weight, organ weights or haematological parameters. No differences in chromium content of different organs of two groups were evident. These data suggest that addition of 0.05% sodium chromate to the steep water (to prevent development of off-odour) during parboiling of paddy was toxicologically safe.
- Report(s) : Annual.
- Papers Published : 1. Nageswara Rao, C. and Narasinga Rao, B.S. Effect of long term feeding of chromate treated parboiled rice in rats. Indian J. Med. Res. 73; 1981; 357-62

- 274 Project Title : Effect of agronomic inputs (fertilisers) on the milling, storage and nutritive quality of paddy and bengal gram.  
 Organisation : Jawaharlal Nehru Krishi Vishwa Vidyalaya; College of Agricultural Engineering, Jabalpur-482 004.  
 Project Category : Applied.  
 Cost : -  
 Duration : May 1978-December 1979.  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Gupta, O.P. and others.  
 \*239
- 275 Project Title : Manufacture of cement from paddy husk.  
 Organisation : Indian Institute of Technology, Kharagpur-721302; Post-harvest Technology Centre.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 1,94,000/-  
 Duration : March 1981-March 1984.  
 Sponsor(s) : Government of West Bengal.  
 Investigator(s) : Bal, Satish and Ojha, J.P.  
 Description : The project is being initiated to develop suitable technology for manufacturing cement on small scale.  
 Report(s) : -  
 Papers Published : -
- 276 Project Title : Aflatoxin contamination in cyclone affected regions.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad-500 007.  
 Project Category : Applied and Survey.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : Paddy samples (438 nos.) collected from the zone affected by cyclone storm were analysed. It was found that 10.9% of samples were contaminated with aflatoxin. The levels being  $< 0.03$  ppm in 5.02% of the samples, from 0.03 to 0.1 ppm in 3.4% and from 0.1 to 0.5 ppm in 2.5%. In addition to aflatoxin, other toxins like ochratoxin (3.8%), zearalenone (2.9%) and sterigmatocystin (1.6%) were also detected. However, it was observed that one affected paddy sample was always contaminated with a single type of mycotoxin. The overall results showed that a total of 18.9% of the samples were contaminated with mycotoxins which was invariably associated with discolouration. It was suggested on the basis of these findings that inclusion of a mycotoxin screening program in the normal activities of Food and Drug Laboratories of the State Public Health Departments was advisable.  
 Report(s) : Annual  
 Papers published : -
- 277 Project Title : Influence of high fertilisation on the quality of crop produce.  
 Organisation : Tamil Nadu Agricultural University; Agricultural College and Research Institute, Madurai- 625 104; Agricultural Chemistry and Soil Science Department.  
 Project Category : Applied.  
 Cost : -  
 Duration : June 1972-1979.  
 Sponsor(s) : University.  
 Investigator(s) : Kandaswamy; Balakrishnana, T.  
 \*240



- 278 Project Title : Studies of rice production and processing system for identification of problems and their solution (Punjab, Haryana, Vidarbha region and Andhra Pradesh).
- Organisation : Central Food Technological Research Institute, Mysore-570013, Rice and Pulse Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 4,48,900/-.
- Duration : April 1982-March 1986.
- Sponsor(s) : Institute.
- Investigator(s) : Bhattacharya, K.R. and others.
- Description : The project intends to study the loss of moisture and deterioration in rice quality and milling quality during storage of paddy in different types of storage systems prevalent in the region. It also studies the prevalent dry methods of paddy and gives suggestions for improvements. Use of rice bran for oil extraction with provision of alternate raw material for poultry feed is also attempted. The different methods of parboiling of paddy are tested and the production and utilisation of paddy husk and white husk-ash are attempted.
- Report(s) : -
- Papers Published : -
- 279 Project Title : Evaluation of paddy varieties/hybrids for quality.
- Organisation : Narendra Dev University of Agriculture and Technology: Faizabad-224 001.
- Project Category : Applied.
- Cost : -
- Duration : July 1971-.
- Sponsor(s) : Government of Uttar Pradesh.
- Investigator(s) : Srivastava, M.K. and others.
- \*241
- 280 Project Title : Rice processing and by product utilization.
- Organisation : Central Rice Research Institute, Cuttack-753 006, Orissa.
- Project Category : Applied.
- Cost : Rs. 65,000/-.
- Duration : 1979 onwards.
- Sponsor(s) : Indian Council of Agricultural Research.
- Investigator(s) : Lodh, S.B. and others.
- Description : The project envisages the polishing and utilization of rice including broken ones; stabilization and utilization of rice bran; and identification of the nutritional constituents of rice straw.
- Report(s) : Annual report of CRRI.
- Papers Published : 1. Bhaskar Das and Lodh, S.B. Rice bran proteins and their sub-units. The Plant Biochem. J. 5; 1978; 58  
2. Bhaskar Das and Lodh, S.B. Effect of storage and technological operations on the analytical characters of rice bran oil RPEC Reporter 4; 1978; 1  
3. Bhaskar Das and Lodh, S.B. Rice bran - a potential source of oil. International Congress on Oil and Oilseeds, held at New Delhi 9-13 February 1979.  
4. Bhaskar Das and Lodh, S.B. Effect of technological operations on the nutrititional constituents of rice bran. 68th All India Sci. Congr., Hyderabad, 1979.  
5. Bhaskar Das and Lodh, S.B. Effect of physico-chemical treatments on the constituents of rice straw. 67th Indian Sci. Congr., Calcutta, January 3-7, 1980.

6. Dash, A.B. and others. Determination of polishing time for different rice varieties to obtain 5% polish. Seminar on Modern Rice Milling Technology, Department of Technical Education, Tamil Nadu Polytechnic, Madurai.
7. Lodh, S.B. and Bhaskar Das. Rice bran a potential source of protein. International Symposium on recent advances in food science and technology, Jan.9-11, 1980.
8. Pullaiah, T. and Lodh, S.B. Studies on the development of free fatty acids in rice bran. ORYZA 17; 1980; 188
9. Sahay, M.N. and others. Studies on the effect of processing conditions on protein sub-units and quality features of rice. ORYZA 14; 1977; 77
10. Sahay, M.N. and others. Effect of parboiling on quality feature of rice. 67th All India Sci. Congr., Ahmedabad 1978
11. Sahay, M.N. and others. Studies on polishing time and its effect on head rice yield. ORYZA 17; 1980; 235
12. Samantaray, R.N. and others. Effect of sodium-chloride spray on the technological quality of rice grain. ORYZA 15; 1978; 151

- 281 Project Title : Polishing and utilisation of rice including broken.
- Organisation : Central Rice Research Institute, Cuttack-753 006.
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : ICAR
- Investigator(s) : Sahay, M.N.; Lodh, S.B.
- Description : Ten varieties of rice (Jagannath, NC 1281, Pusa 2.21, Padma, Krishna, Vijaya, Mahsuri, CR 1024, Ratna and Vani) were dehulled dehulled and polished for 30-180 seconds. The amount of polish (bran+broken) increased and the head rice yield decreased with increasing polishing time. The time required to obtain 5% polish varied with the varieties. It was recommended that during polishing, time of polishing should not be kept fixed. The actual time required for obtaining 5% polish in the specific varieties should be determined first and polishing with large quantum of dehulled rice done accordingly to obtain optimum head rice yield.
- Report(s) : -
- Papers Published : 1. Sahay, M.N. and others. Studies on polishing time and its effect on head rice yield. (communicated).
- 282 Project Title : Modernisation of traditional process of making avalakki (poha) for yield increase and to produce a quick cooking form of rice.
- Organisation : Central Food Technological Research Institute, Mysore-570 013; Rice and Pulse Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 1,96,260/-.
- Duration : April 1980-March 1982.
- Sponsor(s) : CSIR
- Investigator(s) : Narasimha, H.V. and others.
- Description : The breakage encountered in the traditional batch processing method using edge-runner were reduced and yield increased by providing a second idle roller to the machine thereby reducing flaking time. The tempering time between roasting and flaking had to be increased to about 12-15 minutes to prevent lumping. A prototype mini roller flaker was fabricated and tested to effect further improvements. The continuous flaking method using a centrifugal sheller and the mini flaker gave 70% yield as against 64% obtained by the traditional method using edge runner.



Efforts were also made to reduce cooking time of parboiled rice and it was found that the technique of 'bumping' by passing it between two flaking rollers and present to a thickness of 0.4 mm reduced cooking time by about 50%. Even pressure parboiled rice is amenable to this treatment which reduced both cooking time and energy consumption. HTST treatment (150 C) for 1 minute produced mild fissures and slight puffing in the parboiled rice resulting in shortened cooking time.

Report(s) : Final  
 Papers Published : 1. Chinnaswamy, R. and Bhattacharya, K.R. Studies on expanded rice. Optimum processing conditions. J. Food Sci. 48(6); 1983; 1604.  
 2. Chinnaswamy, R. and Bhattacharya, K.R. Studies on expanded rice. Physico-chemical basis of varietal differences. J. Food Sci. 48(6); 1983; 1600.

\*\*283

283 Project Title : Modification of the indigenous beaten rice (poha, Avalakki) process for cost reduction and higher yield of product.  
 Organisation : Central Food Technological Research Institute, Mysore-570 013; Rice and Pulse Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 2,02,000/-.  
 Duration : April 1977-March 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Desikachar, H.S.R. and others.  
 Description : Various parameters in the traditional process were studied and based on the results, a continuous process was developed and standardised. The method involves: (a) soaking of paddy in hotwater (60-70 C) for 18-20 hours, (b) roasting of soaked paddy in a 'gram roaster' using sand as heat medium (contact time of sand with paddy, 1 minute), (c) immediate shelling of roasted paddy in a centrifugal sheller, and (d) flaking in a roller flaking equipment. The yield of rice flakes was 69-72% depending on the degree of polish. Conditions were also worked out for flaking of rice instead of paddy in the conventional 'edge-runner' of the poha machine. Experiments will be carried out on this process in separate project.  
 Report(s) : Final.  
 Papers Published : 1. Ananthachar, T.K. and others. Improvement of traditional processes for rice flakes. J. Food Sci. Technol. 19; 1982; 47.  
 2. Narasimha, H.V. and others. Development of a continuous process for making rice flakes. J. Food Sci. Technol. 19; 1982;

\*\*282

284 Project Title : Studies on the biochemical constituents of rice varieties: amino acid analysis in rice seeds.  
 Organisation : Central Rice Research Institute, Cuttack - 753 006  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Lodh, S.B. and others.  
 Description : Different varieties of rice (7 samples) were hydrolysed in 6N HCl and were freed of HCl by flash evaporator under vacuum. Two samples in duplicate were analysed for their amino acid composition.  
 Report(s) : -  
 Papers Published : -

- 285 Project Title : Evaluation of rice varieties for biochemical and technological quality.
- Organisation : Central Rice Research Institute, Cuttack - 753 006, Orissa.
- Project Category: : Applied.
- Cost : Rs. 48,000/-.
- Duration : 1979 onwards.
- Sponsor(s) : Indian Council of Agricultural Research.
- Investigator(s) : Lodh, S.B.; Nanda, B.B.
- Description : The project aims to evaluate pre-released varieties of rice for biochemical and technological qualities.
- Report(s) : Annual report of CRRI.
- Papers Published : 1. Lodh, S.B. Studies on heterogeneties of rice glutelin. Indian J. Biochem. and Biophys. 15; 1978 Suppl.5.
2. Mandal, S. and others. Free amino acid, protein and nucleic acid content in developing kernel of six rice cultivars. The Plant Biochem. J. 5; 1979; 24.
3. Mandal, S. and others. Evaluation of six rice varieties for protein quality. 48th Annual Meeting of Soc. Biol. Chemists (India) held at Lucknow during October, 1979.
4. Nanda, B.B. and others. Effect of phosphorus on rice quality. 68th Indian Science Congress Association, Agril. Section. pp.11
5. Nanda, B.B. and others. Physico-chemical changes between developing kernels of high and low protein cultivars of rice. 47th General Meeting of the Soc. Biol. Chemists (India), Delhi, 1978.
6. Nanda, B.B. and others. Effect of periodical planting on protein amylose and yield of rice. ORYZA 13; 1976; 37
7. Sharma, S.C. and others. Effect of nitrogen fertilizer on glutamine synthetase activities of high and low protein cultivars of rice. 47th General Meeting of the Soc. Biol. Chemists (India), Delhi 1978.
- 286 Project Title : Evaluation of rice varieties for biochemical qualities.
- Organisation : Central Rice Research Institute, Cuttack- 753 006.
- Project Category : Applied.
- Cost : Rs. 48,000/-.
- Duration : 1979 onwards.
- Sponsor(s) : ICAR
- Investigator(s) : Lodh, S.B. and others.
- Description : Total protein, amylose content, total fat and mineral composition (Fe, Mn, Pi, K and Ca) were studied in freshly harvested and one year stored samples of the varieties, Co.13 and Lalna-kanda-41. Result showed that storage had no effect on protein and amylose content. The total fat, free fatty acids and certain mineral like Pi were more in stored paddy.
- Report(s) : Annual report of CRRI
- Papers Published : \*\*285
- 287 Project Title : Evaluation of rice varieties for technological qualities.
- Organisation : Central Rice Research Institute, Cuttack - 753 006.
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : ICAR
- Investigator(s) : Lodh, S.B.
- Description : A large number of scented cultures of paddy were screened and the acceptable features were recommended for Basumathi type rice kernels which included those for small (fine white and after cooking), cooked kernel quality (kernels well separated, non-sticky,



no hard core), size of milled kernels (length 6.5 mm, breadth 2.00 mm, L/B ratio approx. 3.5 and above, Milling recovery 40% and above), alkali spreading and clearing value (5.6 at 27-30 C in 1.7% KOH), water uptake (250 ml and above), volume expansion (3.7 and above) length of cooked kernels (10 mm or above) and elongation ratio (1.5 or above).

Report(s) : Annual report.

Papers Published : -

288 Project Title : Parboiling of rice.  
 Organisation : Central Rice Research Institute, Cuttack-753 006.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Spo sor(s) : ICAR  
 Investigat (s) : Sahay, M.N.; Lodh, S.B.  
 Description : Four rice varieties (Jaya, Ratna, Kalinga-1 and Kalinga-2) subjected to parboiling (single and double) were studied for husk content, hulling percent, broken and unbroken brown rice. The differences were significant and were influenced by variety and treatment. Kalinga-2 yielded maximum hulling (78.8%) and unbroken (brown rice 78.4%) while Ratna variety showed the lowest hulling and unbroken brown rice recovery. The impact of parboiling was maximum in Ratna variety as compared to other varieties indicating that the benefit due to parboiling in regard to hulling more or long slender as compared to long bold and short bold varieties. The hulling and unbroken brown rice recoveries in Ratna variety therefore could be considerably improved by parboiling. In coarse varieties, double parboiling could be beneficial.

Report(s) : Annual Report

Papers Published : -

289 Project Title : Studies on newer methods of parboiling and parboiled rice having diverse properties.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Rice and Pulse Technology Discipline.  
 Project Category : Fundamental and Applied.  
 Cost : Rs. 84,800/-.  
 Duration : April 1977-March 1980  
 Sponsor(s) : CSIR  
 Investigator(s) : Bhattacharya, K.R; Zakiuddin Ali.  
 Description : Fat content of rice bran and milled rice was independent of parboiling conditions. Retrogradation induced by addition of water did not alter the degree of gelatinisation. Though retrogradation could be partially or fully reversed by heat treatment at optimum moisture levels, water uptake during cooking of parboiled rice did not improve. At low temperatures the swelling property of parboiled rice was more than raw rice but not at high temperatures which explained the anomalous viscogram of parboiled rice. Parboiling reduced the apparent solubility of cooked rice after homogenisation and the consistency of alkaline paste gel. Hot water soaking and pressure parboiling methods were tried with several varieties of rice. The soaking temperature in the former method depended on the gelatinisation temperature of the varieties and in the later method,, the initial moisture was an important parameter which had to be counteracted by the degree of pressure and steaming duration.

Report(s) : Final

## Papers Published

1. Ali, A.Z. and Bhattacharya, K.R. High temperature drying cum parboiling of paddy. J. Food Proc. Eng. 4; 1980; 123.
2. Ali, S. Z. and Bhattacharya, K.R. Changes in sugars and aminoacids during parboiling of rice. J. Food Biochem.- 4; 1980; 169.
3. Ali, S.Z. and Bhattacharya, K.R. Pasting behaviour of parboiled rice. J. Text. Stud. 11; 1980; 239
4. Ali, S.Z. and Bhattacharya, K.R. Studies on pressure parboiling of rice. J. Food Sci. Technol. 19; 1982; 236
5. Unnikrishnan, K.R. and Bhattacharya, K.R. Swelling and solubility behaviour of parboiled rice flour. J. Food Technol. 16; 1981; 403
6. Unnikrishnan, K.R. and others. Parboiling of paddy by simple soaking in hot water. J. Food Technol. 17; 1982; 499

290 Project Title : Study of biological changes in rice during storage.  
 Organisation : Narendra Dev Univeristy of Agricultural and Technology, Faizabad-224 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : October 1978-October 1980  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Jasra, S. and others.  
 \*243

291 Project Title : Qualitative evaluation of milled rice stored with different proportions of boric acid powder for testing the storability.  
 Organisation : Jawaharlal Nehru Krishi Vishwa Vidyalaya; College of Agricultural Engineering; Jabalpur-482 004.  
 Project Category : Applied.  
 Cost : -  
 Duration : September 1976-December 1979.  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi  
 Investigator(s) : Gupta, O.P. and others.  
 \*252

292 Project Title : Studies on the keeping quality of different food grains with special reference to polished and brown rice in different storage structures.  
 Organisation : Indian Grain Storage Institute, Hapur-245 101  
 Project Category : Applied.  
 Cost : -  
 Duration : 1978-1979.  
 Sponsor(s) : Government of India, Ministry of Agriculture and Irrigation, Department of Food, Krishi Bhavan, New Delhi-110 001.  
 Investigator(s) : Doharey, R.B. and others.  
 \*253

293 Project Title : Development of stabilisation and post-stabilisation technology of rice bran.  
 Organisation : Indian Institute of Technology, Kharagpur-721 302; Post-harvest Technology Centre.  
 Project Category : Fundamental and Applied.  
 Cost : Rs. 2,56,000/-.  
 Duration : September 1981-August 1984  
 Sponsor(s) : Hindusthan Lever Research Foundation, Bombay.  
 Investigator's) : Chattopadhyay, P.K.; Mukherjee, R.K.  
 Description : Various methods of inactivation will be tried: dry heat treatment, wet heat treatment and extrusion. Effect of different



- process variables on the quality of oil extracted and defatted bran under various storage conditions will be studied.
- Report(s) : -  
Papers Published : -
- 294 Project Title : Rice bran stabilisation by infra red heating.  
Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani-431 402; Department of Food Science and Technology.  
Project Category : Applied.  
Cost : Rs. 30,000/-.  
Duration : 1981-1983.  
Sponsor(s) : University and Government of Maharashtra.  
Investigator(s) : Gunjal, B.B.  
Description : Stabilisation of rice bran by infrared heating and temperature distribution under infrared heating have been studied. Based on the data obtained, a continuous rice-bran infra-red stabiliser is being designed. Economic aspects of the commercial use of the stabiliser will also be studied.  
Report(s) : -  
Papers Published : -
- 295 Project Title : Rice bran stabilisation by dielectric heating.  
Organisation : Indian Institute of Technology, Kharagpur-721 302; Post Harvest Technology Centre.  
Project Category : Fundamental and Applied.  
Cost : Rs. 70,000/-  
Duration : June 1980-June 1982.  
Sponsor(s) : Government of India, Ministry of Agriculture, Department of Food.  
Investigator(s) : Chattopadhyay, P.K.; Srinarayana, V.V.  
Description : Physical, thermal and dielectric properties of rice bran have been determined. Inactivation of enzymes by dielectric heating is in progress.  
Project : -  
Papers Published : -
- 296 Project Title : Stabilisation of rice bran.  
Organisation : Jadavpur University, Calcutta-700 032; Food Technology and Bio-Chemical Engineering Department.  
Project Category : Applied.  
Cost : Rs. 90,000/-.  
Duration : 1968-1980.  
Sponsor(s) : Council of Scientific and Industrial Research, New Delhi and University.  
Investigator(s) : Srimani, B.N. and others.  
\*259
- 297 Project Title : Stabilisation and utilisation of rice bran.  
Organisation : Central Rice Research Institute, Cuttack-753 006.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : ICAR  
Investigator(s) : Pallaiah, T.; Lodh, S.B.  
Description : Presence of lipase in rice bran destroys the oil content and quality. Heating at 11°C for 10 minutes controlled the lipase activity. No appreciable change was noticed beyond this range of heating. Maximum destruction of lipase occurred when the bran layer thickness during heating was minimum. The heat treated raw, single and double parboiled rice bran samples could be

stored for 30, 60 and 80 days respectively. The single and double parboiled samples could also be stored for 20 and 60 days respectively without any heat treatment. Storage of bran in polyethylene bags under normal conditions reduced FFA content and cold storage was more effective.

Report(s) : Annual report.

Papers Published : -

298 Project Title : Field level testing and application of improved batch and continuous processes for making rice flakes.

Organisation : Central Food Technological Research Institute, Mysore-570013; Rice and Pulse Technology Discipline.

Project Category : Applied.

Cost : Rs. 6,12,500/-.

Duration : July 1982-July 1984.

Sponsor(s) : CSIR

Investigator(s) : Ananthachar, T.K. and others.

Description : The project envisages the improvement of the rice flaking process for adoption by small scale entrepreneurs and setting up of a continuous unit for large scale production of approximately 250 kg/hr. The roasting process is mechanized in an electrically heated batch roaster. The possibility of reducing the flaking time in the edge runner and retaining plasticity and minimising drying cost and breakage of grain by adding one or more idle roller were studied. Different grades of flakes obtained by using a roller flaker and edge-runner were used in puffing studies. Oil consumption during deep faty frying was also studied. Action is being taken to collect data on specifications for fabricating a heavy duty roller flaker. The need and length for tempering between roasting and swelling and between polishing and flaking was also investigated. The processing cost for the continuous process and traditional process using edge-runner with one or two idle rollers was calculated.

Report(s) : -

Papers Published : 1. Ananthachar, T.K. and others. Improvement of traditional processes for rice flakes. J. Food Sci. Technol. 19; 1982; 47

2. Narasimha, H.V. and others. Development of a continuous process for making rice flakes. J. Food Sci. Technol. 19; 1982; 233

299 Project Title : Processing of edible grade oil from rice bran: I. Beneficiation and appropriate stabilisation techniques for bran from huller type rice mills.

Organisation : Central Food Technological Research Institute, Mysore-570013; Rice and Pulse Technology Discipline.

Project category : Applied.

Cost : Rs. 3,58,900/-

Duration : June 1982-June 1984.

Sponsor(s) : Institute.

Investigator(s) : Indhudhara Swamy, Y.M. and others.

Description : See papers published.

Report(s) : -

Papers Published : 1. Desikachar, H.S.R. Production of edible grade rice bran oil in India: Present constraints and future prospects. Presented at South India Conference on Rice Bran oil industry, Rice Bran Solvent Extractors Association, Vijayawada, 1982.

2. Ramaswamy, K.G. and others. Refining of rice bran oil. J. Oil Technol. Assoc. India. 12(1); 1980; 15.



- 300 Project Title : Miscella refining of crude rice bran oil and recovery of by-products - wax, oryzanol and vitamin E-rich germ oil.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Lipid Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,66,000/-  
 Duration : June 1980-December 1982  
 Sponsor(s) : Institute  
 Investigator(s) : Sen, D.P. and others.  
 Description : -  
 Report(s) :  
 Papers Published : 1. Ramaswamy, K.G. and others. Refining of rice bran oil. J. Oil Technol. Assoc. India. 12(1); 1980; 15.  
 \*\*299 Wheat and Triticale
- 301 Project Title : Relationship of physico-chemical properties of wheat proteins with chapathi qualities.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition, Division.  
 Project Category : Fundamental and Applied.  
 Cost : Rs. 1,68,600/-.  
 Duration : April 1978-March 1981.  
 Sponsor(s) : Institute.  
 Investigator(s) : Nigam, S.N.; Ram, B.P.  
 Description : -  
 Report(s) : Final.  
 Papers Published : 1. Ram, B.P. and Nigam, S.N. Sodium dodecyl sulphate-polyacrylamide gel electrophoresis of reduced glutenin of wheats; subunit differences in relation to variety and baking quality. Presented at the Second Congress of the FAOB and Golden Jubilee Annual Meeting of the Society of Biological Chemists (India) Bangalore, Dec. 1980
- 302 Project Title : Studies on the changes in the physicochemical and functional properties of wheats during storage under tropical conditions.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Flour Milling and Baking Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,67,400/-.  
 Duration : April 1978-December 1980.  
 Sponsor(s) : CSIR  
 Investigator(s) : Shurpalekar, S.R. and others.  
 Description : Several varieties of wheat stored under different conditions (27 C and 65% RH; 37 C and ambient RH; room temperature and RH) were studied. The acidity of the extracted fat, diastatic activity and sedimentation value increased during storage. The farinograph water absorption and stability increased while the mixing tolerance index decreased. The resistance to extension and ratio figure increased indicating overall improvements in dough characteristics. The breads prepared from stored wheat were superior in regard to both the loaf volume and crumb characteristics. No change in chapati making quality was noticed.  
 Report(s) : Final.  
 Papers Published : 1. Shurpalekar, S.R. and others. Quality evaluation of Indian wheats - IET and VRT varieties. Presented at All India Wheat Research Workshop, Bangalore, August 1982.  
 \*263

- 301 Project Title : Studies on the characterisation and utilisation of products obtained from traditional milling process.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Flour Milling and Baking Technology Discipline.
- Project Category : Applied and fundamental.
- Cost : Rs. 1,40,700/-.
- Duration : July 1980-June 1982.
- Sponsor(s) : CSIR
- Investigator(s) : Shurpalekar, S.R. and others.
- Description : Trials were conducted with 100 kg batch size of commercial Punjab wheat and based on it, a simple milling process was worked out with the main objective of obtaining different milled products flour suitable for bread and atta for chapati. The wheat polished to 7-10% could give 30-35% yield of bread flour and 30-40% of biscuit flour. The ash values of the flour were around 0.8%. The remaining fraction was partly reground to give roti/chapati flour having an ash content of 1.6%. The trial indicated that while the huller and chakki could easily process 100 kg wheat, constraints in sieving efficiency of the sifter prolonged the process time. Necessary improvement for the sifter are in progress.
- Report(s) : -
- Papers Published : 1. Haridas Rao, P. and others. Comparative studies on whole wheat atta and resultant atta, a byproduct of roller flour milling industry. J. Food Sci. Technol. 20(1); 1983; 5  
2. Leelavathi, K. and others. Utilisation of resultant atta - a byproduct of roller flour milling industry. Presented at Symposium on By-Products from Food Industries: Utilisation and Disposal, CFTRI, May 1980.  
3. Shurpalekar, S.R. and others. Processing, nutritive value and food uses of wheat germ, a byproduct of flour milling industry. Presented at Symposium on By-product from Food Industries: Utilisation and Disposal, CFTRI, Mysore, May 1980.  
4. Shurpalekar, S.R. and others. Simple process for the milling of wheat for bakery flour and atta. Presented at Ahara 82: International Food Conference, Bangalore, May 1982.
- 304 Project Title : Studies on microbial pollution in air borne dust at post-harvest operation of wheat crop.
- Organisation : Indian Grain Storage Institute, PO Box 10, Hapur- 245 101.
- Project Category : Applied.
- Cost : -
- Duration : May 1980-November 1980.
- Sponsor(s) : Government of India, Ministry of Agriculture and Irrigation, Department of Food.
- Investigator(s) : Singh, T.; Tyagi, R.P.S.
- Description : The project aims to find out the load of microbial spores in airborne dust at harvesting, threshing, cleaning in mandis and unloading and filling at silos.
- Report(s) : -
- Papers Published : -
- 305 Project Title : Production of vitamin E concentrate from wheat germ.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Lipid Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 36,915/-.
- Duration : Dec. 1978-Sept. 1979.
- Sponsor(s) : M/s Ranbaxy Laboratories, Okhla, New Delhi.



- Investigator(s) : Sen, D.P. and others.  
 Description : Four samples of wheat germ were analysed for moisture and volatile matter (8.5-10.6%) fat, (6.7 to 9.4%) and total tocopherols (51-250 mg/100 g oil). Five different solvents were used for preferential extraction of tocopherols directly from the germ. Polar solvents gave nearly 50-70% higher extraction of tocopherols than the non-polar solvent.  
 Report(s) : -  
 Papers Published : -
- 306 Project Title : Thin layer batch drying of wheats.  
 Organisation : University of Allahabad; Allahabad Agricultural Institute, Allahabad-211 007; Agricultural Engineering Department.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1972-.  
 Sponsor(s) : University.  
 Investigator(s) : Panday, J.P. and others.  
 \*262
- 307 Project Title : Chemistry of wheat flour in relation to its chapati making quality.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 55,500/-.  
 Duration : April 1977-March 1981.  
 Sponsor(s) : Institute.  
 Investigator(s) : Nigam, S.N.; Ram, B.P.  
 Description : Protein and polysaccharides of various varieties of wheat were studied to elucidate the chemical differences between them and explore ways and means of improving chapati from the point of view of freshness and keeping quality. Procedure for fractionation of wheat flour into starch, albumins, globulins, gliadins, soluble and insoluble glutenin and residue proteins, and their quantitative distribution in 11 wheat varieties were worked out.  
 Report(s) : Final.  
 Papers Published : 1. Ram, B.P. and Nigam, S.N. 'Quality of wheat flour: inter-varietal quantitative differences between gluten components. J. Food Sci. Technol. 16; 1979; 189.  
 2. Ram, B.P. and Nigam, S.N. Stretchability of wheat gluten composition and varietal differences. J. Canad. Inst. Food Sci. Technol. 14; 1981; 326  
 3. Ram, B.P. and Nigam, S.N. Puffing and textural characteristics of chapati in relation to varietal differences in gluten composition. J. Food Sci. 47; 1982; 231.  
 \*270
- 308 Project Title : Trace element composition of different wheat types.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad - 500 007.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : Earlier, data on the composition hard wheat varieties was presented. The project was continued to cover soft and durum wheat varieties. Results of analysis showed that in durum wheat, there were significant varietal differences in Fe, Zn and Mo contents, where as the soft varieties, were essentially similar in compo-

sition. There were significant differences in Ca and Cr content among and three varieties (soft, hard and durum) while Zn and Mo contents were similar. In hard wheat Cu content was lowest; soft wheats contained higher levels of Fe but lower levels of P. Durum wheat were richest in inorganic nutrients while the hard wheat were poorest sources. The wide variations in mineral and trace element composition of the wheats observed to this study were similar to these found with other foodgrains and would be reflected in the intake of these nutrients in the diets based on wheat.

Report(s) : Annual.  
Papers Published : 1. Nageswara Rao, C. and Narasinga Rao, B.S. Trace element content of Indian Foods and dietaries. Indian J. Med. Res. 73; 1981; 904-9.

309 Project Title : Studies on Karnal bunt disease in wheat during storage.  
Organisation : Indian Grain Storage Institute, P.B.No. 10, Hapur- 245 101.  
Project Category : Applied.  
Cost : -  
Duration : 1980-..  
Sponsor(s) : Government of India, Ministry of Agriculture and Irrigation, Department of Food.  
Investigator(s) : Singh, T.; Tyagi, R.P.S.  
Description : The project detects the percentage of bunt grain, their weight, effect on germination and on yield of milled products (atta and maida) of wheat.

Report(s) : -  
Papers Published : 1. Singh, T. and Tyagi, R.P.S. Studies on quantitative loss of wheat products due to Karnal bunt. Indian Miller. 12(4); 1982; 5.  
2. Singh, T. and others. Studies on role of Karnal bunt in spoilage of wheat grain in India. (Communicated)

310 Project Title : Rheological and baking properties of irradiated Indian wheat.  
Organisation : Bhabha Atomic Research Centre, Bombay - 470 085.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Centre.  
Investigator(s) : Rao, V.S.; Vakil, U.K.  
Description : Effects of gamma radiation on wheat have been studied with special reference to rheological and baking properties. Maximum gelatinization, viscosity of starch, water absorption capacity as well as elasticity of gluten are significantly influenced by radiation treatment of wheat at 0.2 to 2.0 kGy dose levels. The baking quality of wheat, irradiated at lower doses is improved, resulting in increased loaf-volume. No significant changes due to radiation treatment in external and internal sensory attributes of bread are observed, when evaluated by taste panel. Similarly, the fumigation had no deleterious effects on the rheological and baking properties of wheat, stored upto eight months.

Report(s) : -  
Papers Published : 1. Sudha Rao, V. and others. Comparative storage studies on fumigated and irradiated wheat. Acta Alimentaria. 5(3); 1976; 253  
2. Sudha Rao, V. and others. Studies on rheological and baking properties of irradiated Indian wheat. Acta Alimentaria. 7(1); 1978; 91



- 311 Project Title : Biochemical studies with gamma-irradiated wheat: Nucleic acid and protein synthesis in germinating wheat.  
 Organisation : Bhabha Atomic Research Centre, Bombay-470 085.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Machaiah, J.P.; Vakil, U.K.  
 Description : A metabolic disturbance, as revealed by biosynthetic events leading to protein synthesis is observed in gamma-irradiated wheat. Initiation of RNA, DNA and protein syntheses are triggered at lower rate in germinating wheat, irradiated at 2 kGy. These adverse effects can be partially reversed by pre-treatment of seeds with GA.  
 Report(s) : -  
 Papers Published : 1. Machaiah, J.P. and Vakil, U.K. Ind. J. Biochem. Biophys. 17; 1980; 85
- 312 Project Title : Biochemical studies with gamma-irradiated wheat: Purification and physico-chemical properties of alpha-amylase from irradiated wheat.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Machaiah, J.P.; Vakil, U.K.  
 Description : Alpha-amylases from control and gamma-irradiated wheat seedlings were purified to homogeneity and characterized. Their general and catalytic properties show some differences. A low maximal velocity ( $V_{max}$ ) for the hydrolysis of soluble starch by the enzyme from irradiated wheat suggests some modifications in the formation of the substrate - alpha-amylase complex. The structural alterations, such as loss in total amino acid residues in the enzyme from irradiated wheat may be responsible for its partial inactivation.  
 Report(s) : -  
 Papers Published : 1. Machaiah, J.P. and Vakil, U.K. Purification and physicochemical properties of  $\alpha$ -amylase from irradiated wheat. J. Biosci. 3(2); 1981; 105
- 313 Project Title : Biochemical studies with gamma-irradiated wheat: Effect of gamma-irradiation on the formation of alpha-amylase isoenzymes in germinating wheat.  
 Organisation : Bhabha Atomic Research Centre, Bombay- 470 085.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Machaiah, J.P.; Vakil, U.K.  
 Description : The biosynthesis of alpha-amylase during seedling growth commences after a prolonged lag-period in wheat irradiated at high dose (2 kGy). Also, a different requirement for exogenous gibberellins ( $GA_3$ ) to stimulate the enzyme synthesis is noted in control and irradiated seeds. The developmental patterns of three major isoenzymes of alpha-amylase (designated as  $\alpha_1$ ,  $\alpha_2$  and  $\alpha_3$ ) during germination in control. These results suggest that two systems differing in their radiosensitivity and response to GA application are operating in germinating wheat for the synthesis of functional alpha-amylase molecules.

Report(s) :  
 Papers Published : 1. Machaiah, J.P. and Vakil, U.K. Environ. Exptl. Botany, 19; 1979; 337

314 Project Title : Biochemical studies with gamma-irradiated wheat: Biosynthesis of gibberellins in germinating wheat.  
 Organisation : Bhabha Atomic Research Centre, Bombay - 400 085.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Machaiah, J.P.; Vakil, U.K.  
 Description : Radiation treatment of wheat interferes the process of inter-conversion of inactive gibberellins (GA) (GA<sub>4</sub> and GA<sub>7</sub>) to the highly active one (GA<sub>3</sub>), during early germination. Pre-treatment with known growth retardant, 2-chloroethyl trimethyl ammonium chloride (CCC), a potent inhibitor of kaurene synthetase activity, inhibits in vitro ent(-)kaurene synthesis. Similarly, when seeds are imbibed with CCC prior to germination, in vivo synthesis of GA is significantly reduced and accentuates the radiation-induced damage in wheat seedlings.

Report(s) : -  
 Papers Published : 1. Machaiah, J.P. and Vakil, U.K. Environ. Exptl. Botany 16; 1976; 131  
 2. Machaiah, J.P. and Vakil, U.K. Environ. Exptl. Botany 22; 1982;

315 Project Title : Comparative studies on physico-chemical and baking properties of newly harvested and stored wheat.  
 Organisation : Bhabha Atomic Research Centre, Bombay - 470 085.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Rao, V.S.; Vakil, U.K.  
 Description : Freshly harvested wheat contained a larger amount of low molecular weight gliadins, which were aggregated during storage in air. This resulted in improvement of the rheological and baking properties of stored grains. These results suggested that the interchange reactions between thiol and disulphide during storage, governed the dough rheology. A significant correlation between SS/SH ratio and loaf volume was observed. Radiation treatment (0.2 kGy) improved the baking quality of newly harvested wheat by modifying some of its rheological properties.

Report(s) : -  
 Papers Published : 1. Sudha Rao, V. and others. Comparative studies on physico-chemical and baking properties of newly harvested and stored Indian varieties of wheat. J. Sci. Fd. Agric. 29; 1978; 155

316 Project Title : Effect of gamma-irradiation of wheat on wheat volatile flavour components of bread.  
 Organisation : Bhabha Atomic Research Centre, Bombay 470 085.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Rao, V.S.; Vakil, U.K.



- Description : Comparative sensory and objective evaluations of bread prepared from wheat flour, irradiated at different doses have been carried out. Total carbonyl contents are increased in irradiated products. A significant inverse correlation between consumer preference and total carbonyls as well as GLC headspace vapour analysis is established. It is suggested that off-flavour imparting compounds in irradiated wheat may arise from the volatile degradation products of amino acids and proteins or by their interaction with reducing sugars, the ultimate radiation-induced breakdown products of starch.
- Report(s) : -
- Papers Published : 1. Rao, V.S. and others. J. Food Sci. 43; 1978; 68
- 317 Project Title : Utilisation of triticale in Indian food products.
- Organisation : University of Agricultural Sciences; Bangalore-560 024; Economics Department.
- Project Category : Applied.
- Cost : Rs. 1,04,000/-.
- Duration : April 1978-April 1980.
- Sponsor(s) : Government of India, Department of Science and Technology.
- Investigator(s) : Vaidehi, M.P.
- \*276
- Milletts
- 318 Project Title : Formulation of different recipes from minor millets.
- Organisation : Tamil Nadu Agricultural University; Agricultural College and Research Institute, Coimbatore - 641 003; Food Technology Department.
- Project Category : Applied.
- Cost : Rs. 50,000/-.
- Duration : 1972-1980.
- Sponsor(s) : University.
- Investigator(s) : Shanthi, A.P.
- \*278
- 319 Project Title : Studies on malting and puffing of millet grains for better nutritive value and consumer acceptability.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Rice and Pulse Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 5,03,230/-.
- Duration : April 1981-March 1984.
- Sponsor(s) : Institute.
- Investigator(s) : Desikachar, H.S.R. and others.
- Description : Puffing and malting characteristics of various millet grains like Ragi, Bajra, Navane, Varagu, Pani varagu, Bajra and Sorghum were studied to optimise condition for these processes and also identify suitable varieties from genetic stocks. Various recipes of weaning/snack/breakfast foods are also being developed with malted and puffed millets. A weaning food based on Ragi and green gram was developed and this formulation had good storage properties and nutritive value. This process has been released for practical exploration. Further studies are continuing.
- Report(s) : -
- Papers Published : 1. Malleshi, N.G. and Desikachar, H.S.R. Formulation of a weaning food with low hot-paste viscosity based on malted ragi (*Eleusine coracana*) and gram (*Phaseolus radiatus*). J. Food Sci. Technol. 19; 1982; 193
2. Malleshi, N.G. and Desikachar, H.S.R. Studies on the suitability of roller flour mill, hammer mill and plate grinder for obtaining a refined flour from malted ragi (*Eleusine coracana*). J. food Sci. Technol. 18; 1981; 37.

3. Malleshi, N.G. and Desikachar, H.S.R. Varietal difference in puffing quality of ragi. J. Food Sci. Technol. 18; 1981; 30
4. Malleshi, N.G. and others. Production of low cost malted weaning food from ragi. Khadi Gramodyog. 29; 1982; 403

- 320 Project Title : Studies on the proteins and carbohydrates of minor millets with special reference to Italian Millet (*Setaria italica*).
- Organisation : Central Food Technological Research Institute, Mysore-570 013; Biochemistry and Applied Nutrition Discipline.
- Project Category : Fundamental.
- Cost : Rs. 1,27,000/-.
- Duration : Nov.1978-Nov.1979.
- Sponsor(s) : University of Agricultural Sciences, Hebbal, Bangalore.
- Investigator(s) : Raja Gopal Rao, D.; Vincent Monteiro.
- Description : Proximate analysis of fourteen different varieties of Italian millet revealed low (11.1%), medium (15%) and high (19.7%) protein varieties. Most of the samples had an average protein content of 13%. The average husk and fat content was around 23 and 5.2% respectively. Prolamine constituted 60-70% of the total protein followed by glutenin. The sub-unit size of the prolamine components were similar in the low, medium and high protein groups but the albumin-globulin and glutelin components were different. The pentosan content of the dehusked whole flour of different varieties of Italian millet was found to be in the range 1.22-2.23%.
- Report(s) : -
- Papers Published : -
- 321 Project Title : Trace element composition of millets.
- Organisation : National Institute of Nutrition, Tarnaka, Hyderabad - 500 007.
- Project Category : -
- Cost : -
- Duration : -
- Sponsor(s) : ICMR
- Investigator(s) : -
- Description : High yielding varieties of millets (bajra, ragi, French millet and Kodo millet) were studied for their contents of trace elements (Zn, Mn, Cu and Cr) and minerals (Ca, P and Fe). Ash content was highest in French millet (4.36%) and lowest in bajra (1.81%). The millets differed markedly in trace element composition: ragi was a good source of Ca and Mn, French millet of Cu, Zn and Fe and kodo millet of Cu, Fe and Cr. Varietal differences for minerals were minimal except for Fe and Cr in bajra and Mn in kodo millet. Compared to other cereals, whole grain millets, were good sources of minerals. Millets are also rich in phytate, a limiting factor for utilisation of minerals. It was found that the phytate phosphorus was least in kodo millet (30% of total P) but fairly rich in French millet (80% of total P). In bajra and ragi it was 40-50% of total P. The minor millets have a kernel ratio of 25-75 to 45-55 and the hulls are good source of fibre, tannin and phytate which limits utilisation of several nutrients. Studies are therefore underway to determine the trace element composition of dehulled millets.
- Report(s) : Annual
- Papers Published : 1. Deosthale, Y.G. Mineral and trace element composition of maize. Curr. Sci. 48; 1979; 54
2. Radhakrishnan, M.R. and Sivaprasad, J. Tannin content of sorghum varieties and their role in iron bioavailability. J. Agric. Food Chem. 28; 1980; 55



## Ragi

- 322 Project Title : Pentosans of Finger millet.  
 Organisation : University of Agricultural Sciences, GKVK Campus, Bangalore 560 065; Department of Biochemistry.  
 Project Category : Fundamental and exploratory.  
 Cost : Rs. 10,000/-  
 Duration : Jan.1977-1978.  
 Sponsor(s) : University.  
 Investigator(s) : Geetha Ramachandra and Monteiro, P. Vincent.  
 Description : The pentosans of some varieties of finger millet were estimated. The water-soluble and alkali-soluble pentosans of two varieties of the millet were isolated and characterised. The monosaccharides present in the isolated pentosan fractions were identified and estimated.  
 Report(s) : -  
 Papers Published : 1. Geetha Ramachandra and Monteiro, V.P. Pentosans of finger millet. Proc. Indian Acad. Sci. 88:B; 1979; 29  
 \*283
- 323 Project Title : Lactic fermented beverages from ragi.  
 Organisation : Central Food Technological Research Institute, Mysore-570 013;  
 Project Category : Applied.  
 Cost : Rs. 0.35 lakhs.  
 Duration : April 1979 - Oct. 1979  
 Sponsor(s) : Institute.  
 Investigator(s) : Satyanarayana Rao, B.A. and others.  
 Description : Powdered ragi as such or after passing through fine mesh left a grainy feeling on the tongue in the lactic fermented product. Attempts made to remove the outer husk from ragi powder by sieving were unsuccessful. However, wet milling of ragi and sieving through nylon mesh gave starch which was free from husk and this material was cooked and in conjunction with glucose and citrate gave an acceptable product on fermentation with a selected lactic culture. Lactic fermented product (base material) on dilution with water and on seasoning with coriander, curry leaves, ginger and salt gave a refreshing drink. The base material was used to prepare majjigehuli a common domestic preparation from milk curd, and was found most acceptable. Since the protein content was only about 0.9%, attempts were made to incorporate various pulses, milk powder, milk and soya milk to increase the protein level. Incorporation of milk or milk powder gave a very satisfactory product. Addition of soya milk gave an excellent product but it had the beany taste. Addition of synthetic flavours masked the fermented flavour.  
 Report(s) : Annual  
 Papers Published : 1. Prasad, M.S. and Satyanarayana, Rao, B.A. Malt-based syrups in brewing. J. Food Sci. Technol. (Communicated)  
 2. Venkatanarayana, S. and others. The use of ragi (Eleusine coracana) in brewing. J. Food Sci. Technol. 16(5); 1979; 204
- 324 Project Title : Studies on nutritive value of newer varieties of jowar (Sorghum vulgare).  
 Organisation : Institute of Science, 15 Madam Cama Road, Bombay-400 032.  
 Project Category : Exploratory.  
 Cost : -  
 Duration : November 1975-  
 Sponsor(s) : Institute.  
 Investigator(s) : Inamdar, A.N.; Kelkar, S.S.  
 \*291

- 125 Project Title : Plant proteinase inhibitors of finger millet.  
 Organisation : Bangalore University, Central College, Department of Chemistry.  
 Project Category : Fundamental.  
 Cost : Rs. 75,000/-.  
 Duration : 1976-1982.  
 Sponsor(s) : University.  
 Investigator(s) : Veerabhadrapa, P.S. and others.  
 Description : The project aims to study the presence of proteinase inhibitors in finger millet (Ragi) which is an important millet of South India. A trypsin inhibitor in its homogenous state has been isolated and purified from finger millet using conventional purification techniques. The trypsin inhibitor has also been shown to be active in inhibiting both salivary and pancreatic  $\alpha$ -amylase activity. The mechanism of interaction of finger millet trypsin inhibitor with trypsin has been studied with the help of certain physico-chemical properties.
- Report(s) : -  
 Papers Published : 1. Veerabhadrapa, P.S. and others. Proteinase inhibitors of finger millet (Eleusine coracana Gaertn.). J. Sci. Food Agric. 29; 1978; 353  
 \*284
- Jowar
- 326 Project Title : Rural level flour milling of sorghum in Akola District.  
 Organisation : Punjab Rao Krishi Vidyapeeth, Akola - 444 104; Harvest and Post harvest technology scheme.  
 Project Category : Applied.  
 Cost : Rs. 50,000/-.  
 Duration : 1980-1983.  
 Sponsor(s) : Indian Council of Agricultural Research and Government of Maharashtra.  
 Investigator(s) : Umbarkar, SP. and others.  
 Description : The project investigates the operation and economics of rural level flour milling.  
 Report(s) : -  
 Papers Published : -
- 327 Project Title : Studies on the effect of husks on the nutritive value of jowar.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 52,500/-.  
 Duration : April 1977-March 1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Manjrekar, C. and others.  
 Description : Seven sets of PER studies were done to study the effect of jowar husks on the protein utilization. The locally available jowar varieties were used. Their tannin, fat, moisture and protein content was estimated. Also nitrogen balance studies and NPU was done. In a few sets the groupwise quantity of faeces was measured, its protein content estimated. The livers of the rat were analysed on their fat and protein content. The length of the intestine of the rats at the end of PER study was measured and also the weight taken. The results of the PER and NPU study showed that the jowar protein is poorly utilised.  
 Report(s) : Consolidated report.  
 Papers Published : \*293
- 328 Project Title : Effect of pearling on bioavailability of iron from grain sorghum.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad-500 007.  
 Project Category : Applied.



Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : In certain (C.S.V. 2, C.S.V. 5, C.S.V. 6, C.S.H. 7, C.S.H. 8 and SPV 68) of sorghum studied, the iron content varied with varieties and also iron was lost in least amounts during pearling. Results of the present studies show that the ionisable iron varied within narrow range (0.70-1.05 mg/100 g for whole grain and 0.80-1.22 mg/100 g for pearled gram. So significant differences were evident among varieties. In terms of absolute values the ionisable iron content increased after pearling by about 7-22% for the varieties studied. Though pearling altered the total iron content least except for SPV-64 variety, significant improvement in bioavailability of the mineral was noted as judged by the increased ionisable fraction from the average value of 19.6% to 28.7% i.e. an increase by 45%. This improvement was explained by the fact that during pearling tip 10% of the grain comprising mostly of fibre, tannin and phytate (limiting factors for iron utilisation) are removed.

Report(s) : Annual.

Papers Published : 1. Sankar, D.S. and Deosthale, Y.G. Effect of pearling on mineral and trace element composition and ionisable iron content of sorghum. Nutr. Report Internat. 22; 1980; 723  
 2. Prabhavathi, T. and Narasinga Rao, B.S. Effect of domestic preparations of cereals and legumes and ionisable iron. J. Sci. Food Agric. 30; 1979; 592

329 Project Title : Biological evaluation of protein quality of sorghum hybrids.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad - 500 007.  
 Project Category : Applied.  
 Costl : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : Some of the varieties of high yielding sorghum were evaluated for protein quality and protein digestibility using male weaning rats. The NPR of four hybrid varieties, CSH-8, SPH-61, CSH-1 and CSH-6, and a local variety M-35-1, though significantly lower than that of casein, were not significantly different from each other, the values ranging from 1.97-2.19. Relative NPRs (40-43) were also not different from each other for the different varieties. The true digestibility (TD) of CSH-6 was significantly lower ( $P < 0.05$ ) than that of other varieties. The TDA of other sorghum lines were fairly high (89-90%) and almost equal to that of casein (90.91%). The growth performance of the sorghum lines was uniformly poor. The absence of varietal differences in protein quality (though reports of existence of wide variations are available) was attributed to the fact that it was the lysine content and hence the amino acid scores of these lines that were similar. This suggests that screening, for lysine alone may be sufficient to predict protein quality of sorghum varieties. In view of the poor growth when sorghum formed the sole protein source, the detection of minor differences in protein quality was stated to be not possible either by NPR or by PER assay methods.

Report(s) : Annual

Papers Published : -

- 117 Project Title : Effect of pearling on trace element composition of sorghum.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad - 500 007.  
 Project Category : Applied.  
 Cost :  
 Duration :  
 Sponsor(s) : ICMF  
 Investigator(s) :  
 Description : Six varieties of sorghum (C.S.V. 2, C.S.V.5, C.S.V.6, C.S.H. 7, C.S.H. 8 and S.P.V. 68) were studied. Result showed that on pearling, the grains lost maximally in Zn (54%) and Cu (40%) contents. Lesser losses (34-37%) were observed in total ash, Ca, Mg and P contents. A lower percentage of loss occurred in iron (18%). With Zn and Cu losses, the different varieties exhibited a high variability with respect to other inorganic elements. However, it was clear that pearling removes 10% of the upper grain which comprises significant amounts of certain trace elements such as Zn and Cu which needs to be borne in mind, while adopting pearling for improvement of acceptability.  
 Report(s) : Annual  
 Papers Published : \*\*328
- 331 Project Title : Varietal and processing studies on Jowar, Bajra and Ragi, for quality differentiation and improvement.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Rice and Pulse Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 4,84,000/-.  
 Duration : April 1978-Dec. 1980  
 Sponsor(s) : Institute.  
 Investigator(s) : Desikachar, H.S.R. and others.  
 Description : In this all India coordination project, the effect of processing conditions on the above millets and their products were studied. The parameters studied were rolling quality and other quality characteristics of dough, flaking, malting, puffing and toasting, etc. The millet products that were studied included jowar flour, jowar flakes, malted ragi food and the weaning food based on oil, jowar based Bal Ahar, chapati/roti and the pregelatinised extruded products from these millets. Also studied was the processed maize flour as extender of bengal gram flour. A chakki-sieve grinding unit for obtaining refined cereal flours was developed by filling a 3-deck sieving attachment to a commonly used plate grinder. The process of obtaining refined flours from the grinder was also developed and demonstrated.  
 Report(s) : Final  
 Papers Published : 1. Brandzaeg, B. and others. Dietary bulk as a limiting factor for nutrient intake with special reference to feeding of school children. III. Studies on malted flours from ragi, sorghum and green gram. J. Trop. Pediatr. 27; 1981; 184  
 2. Malleshi, N.G. and Desikachar, H.S.R. Formulation of a weaning food with low hot-paste viscosity on malted ragi (*Eleusine coracana*) and gram (*Phaseolus radiatus*). J. Food Sci. Technol. 19; 1982; 193  
 3. Malleshi, N.G. and Desikachar, H.S.R. Malting quality of new varieties of Ragi (*Eleusine coracana*). J. Food Sci. Technol. 16; 1979; 149  
 4. Malleshi, N.G. and others. Production of low cost malted weaning food from Ragi. Khadi Gramodyog. 29; 1982; 403



5. Malleshi, N.G. and Desikachar, H.S.R. Varietal difference in puffing quality of ragi. J. Food Sci. Technol. 18; 1981; 30
6. Malleshi, N.G. and others. Studies on suitability of roller flour mill, hammer mill and plate grinder for obtaining a refined flour from the malted ragi (Eleusine coracana). J. Food Sci. Technol. 18; 1981; 37

- 332 Project Title : Improvement of nutritional and bread making quality of grain sorghum.
- Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani 431 402; Department of Food Science and Technology.
- Project Category : Applied.
- Cost : Rs. 1,07,866/-.
- Duration : January 1980-January 1984.
- Sponsor(s) : University and ICAR
- Investigator(s) : Chavan, J.K. and others.
- Description : Nutritional and functional qualities of sorghum are being assessed to find out its suitability for bread making. A process for bread making using sorghum has been developed and is being standardised. Nutritional quality of sorghum is being evaluated. Fortification of sorghum bread with legume proteins will be explored.
- Report(s) : -
- Papers Published : -
- \*294
- 333 Project Title : Effect of growing season on juice quality of sweet sorghum.
- Organisation : Nimbkar Agricultural Research Institute, Phaltan, District Satora, Maharashtra.
- Project Category : Applied and developmental.
- Cost : -
- Duration : -
- Sponsor(s) : Institute.
- Investigator(s) : Ghanekar, A.R. and others.
- Description : Juice qualities of two varieties of sorghum were studied during monsoon and summer seasons. The analysis was done in two stages, once at the milk stage of grain and once again, when the grain was physiologically ripe. It was found that the crop grown during summer had a low percentage of sucrose in the juice and therefore not suitable for jaggery making. The difference in sucrose percentage between two seasons was possibly due to temperature at the time of maturity. As similar differences also occur in sugarcane and sugar beet, it was suggested that all sugar crops need cold temperature for attaining their maximum sugar content.
- Report(s) : Annual report.
- Papers Published : -
- 334 Project Title : Malting studies on jowar.
- Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani-431 402; Department of Food Science and Technology.
- Project Category : Applied.
- Cost : Rs. 5,000/-.
- Duration : December 1980-February 1983
- Sponsor(s) : University and Government of Maharashtra.
- Investigator(s) : Kadam, P.S. and others.

- Description : Different jowar varieties are being evaluated for malting purposes. Steeping and germination studies have been carried out for the variety M-35-1. Grains steeped for 12 hours were found to have higher germination rate upto 42 hours. Future work is concerned with the study of enzyme synthesis during germination and starch degradation. Studies will also be conducted on the suitability of jowar malt in comparison with malt from wheat and barley.
- Report(s) : -
- Papers Published : -
- 335 Project Title : Evaluation of sundrying using sand bed for jowar.
- Organisation : Punjabrao Krishi Vidyapeeth, Akola - 444 101; Harvest and Post Harvest Technology Scheme.
- Project Category : Applied.
- Cost : Rs. 95,812/-.
- Duration : September 1972-March 1979.
- Sponsor(s) : Indian Council of Agricultural Research, New Delhi.
- Investigator(s) : Muzumdar, G.K. and others.
- \*286
- 336 Project Title : Breeding of sweet sorghum varieties for production of sugar.
- Organisation : Nimbkar Agricultural Research Institute, Phaltan - 415 523.
- Project Category : Applied.
- Cost : Rs. 3,81,945/-.
- Duration : June 1981-June 1986.
- Sponsor(s) : United States Department of Agriculture.
- Investigator(s) : Joshi, A.B. and others.
- Description : Sugarcane, the main raw material of the Indian sugar industry has certain limitations in that it is a long duration crop requiring massive use of irrigation. Sweet sorghum could be an advantageous alternative or a supplementary source as it is a short duration crop with minimum requirement of irrigation. Unlike, sugar beet, sweet sorghum can be processed in the same manner as sugarcane for sugar production. This project aims to breed suitable disease-free varieties and test their chemical and technological properties in order to evaluate their potential in Indian sugar industry. The criteria for selection of varieties for sugar production would be high juice extraction. (>35%), high juice purity (>85%), high sucrose content on stable weight basis (>10%) and resistance or tolerance to all common pests and diseases.
- Report(s) : -
- Papers Published : -
- 337 Project Title : Effect of agronomical input on post harvest quality of jowar and groundnut.
- Organisation : Punjabrao Krishi Vidyapeeth, Akola - 444 104; Harvest and Post Harvest Technology Scheme.
- Project Category : Applied.
- Cost : Rs. 95,812/-.
- Duration : September 1972-March 1979.
- Sponsor(s) : Indian Council of Agricultural Research, New Delhi.
- Investigator(s) : Muzumdar, G.K. and others.
- \*288
- 338 Project Title : Studies on the threshing quality of different varieties of jowar.
- Organisation : University of Agricultural Sciences; G.K.V.K. Campus, Bangalore-560 065; Agricultural Engineering Department.



- Project Category : Applied.  
 Cost : Rs. 1,60,000/-.  
 Duration : 1978-  
 Sponsor(s) : University.  
 Investigator(s) : Javaregowda, S.  
 \*289
- 339 Project Title : Effect of seed composition induced by agronomic practices on storability, viability and milling properties of sorghum.  
 Organisation : University of Agricultural Sciences; Agricultural Engineering Institute, Raichur-584 101.  
 Project Category : Applied.  
 Cost : -  
 Duration : October 1976-October 1979.  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Krishnamurthy, K.C. and others.  
 \*290
- 340 Project Title : Preharvest chemical treatment to control the stored grain pests of sorghum.  
 Organisation : University of Agricultural Sciences; Agricultural Engineering Institute, Raichur-584 101.  
 Project Category : Applied.  
 Cost : -  
 Duration : October 1974-October 1979.  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Krishnamurthy, K.C. and others.  
 \*295
- 341 Project Title : Use of non toxic chemicals for the control of insect pests in stored jowar and groundnut.  
 Organisation : Punjabrao Krishi Vidyapeeth, Akola-444 104; Harvest and Post Harvest Technology Scheme.  
 Project Category : Applied.  
 Cost : Rs. 95,812/-.  
 Duration : September 1972-March 1979.  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Muzumdar, G.K. and others.  
 \*296
- 342 Project Title : Comparative study on popular in-bag fumigants.  
 Organisation : University of Agricultural Sciences; Agricultural Engineering Institute, Raichur-584 101.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1978-1981.  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Krishna Murthy, K.C. and others.  
 \*301

#### Maize

- 343 Project Title : Influence of sulphur fertilisation on the yield of maize and paddy and their quality.  
 Organisation : Tamil Nadu Agricultural University; Agricultural College and Research Institute, Madurai - 625 104; Agricultural Chemistry and Soil Science Department.  
 Project Category : Applied.  
 Cost : -  
 Duration : July 1979-1982.

Sponsor(s) : University.  
Investigator(s) : Paulraj, C.  
Description : The effect of sulphur fertilisation on the protein, sulphur amino acids and carbohydrate contents of the grains will be studied.  
Report(s) : -  
Papers Published : -

- 344 Project Title : Studies on the effect of storage conditions on the quality of maize and bajra.  
Organisation : University of Udaipur; College of Technology and Agricultural Engineering. Udaipur 313 001; Harvest and Post Harvest Technology Scheme.  
Project Category : Applied.  
Cost : -  
Duration : 1973-..  
Sponsor(s) : University; Indian Council of Agricultural Research, New Delhi.  
Investigator(s) : Joshi, V.  
\*305
- 345 Project Title : Study on the changes in nutritional quality of maize grain during heat treatment.  
Organisation : University of Udaipur; College of Technology and Agricultural Engineering, Udaipur 313 001; Harvest and Post Harvest Technology Scheme.  
Project Category : Applied.  
Cost : -  
Duration : 1973-..  
Sponsor(s) : University; Indian Council of Agricultural Research, New Delhi.  
Investigator(s) : Joshi, V.  
\*307
- 346 Project Title : Studies on the changes in nutritional quality of maize and bajra grains during storage in coal tar bins.  
Organisation : University of Udaipur; College of Technology and Agricultural Engineering, Udaipur 313 001; Harvest and Post Harvest Technology Scheme.  
Project Category : Applied.  
Cost : -  
Duration : 1973-..  
Sponsor(s) : University; Indian Council of Agricultural Research, New Delhi.  
Investigator(s) : Joshi, V.  
\*308
- 347 Project Title : Studies on the use of processed maize in the North Indian dietary pattern.  
Organisation : Central Food Technological Research Institute, Experiment Station, Ludhiana.  
Project Category : Applied.  
Cost : Rs. 57,000/-..  
Duration : April 1981-March 1983.  
Sponsor(s) : CSIR  
Investigator(s) : Beerh, O.P. and others.  
Description : It was possible to incorporate of 10-50% maize flour depending on the nature of the product without any adverse affect on acceptability. Suitability of 4 varieties of maize for this purpose was also asseessed. In shelf life studies to find out methods to eliminate the bitterness developed by maize flour and besan on storage, it was found that increase in moisture was



more in friction top cans than in higher guage LDPE. The increase of moisture in maize flour, besan and blends of the two (1:1) was about 2.0-2.2% in all packings (screw cap glass jars, friction top cans and LDPE, 100-400 g) during 6 months storage. Increase in alcoholic acidity was 0.25% in maize flour and blends and 0.15 in besan. It was also found that addition of boiling water improved dough binding in maize flour in most cases, However, some market samples did not respond to this method and efforts are underway to find a solution to this problem.

Report(s) : -  
Papers Published : -

- 348 Project Title : Malting and brewing characteristics of barley and malt.  
Organisation : Central Food Technological Research Institute, Mysore 570 013; Microbiology and Fermentation Technology Discipline.  
Project Category : Applied.  
Cost : Rs. 3,10,400/-.  
Duration : April 1977-March 1979.  
Sponsor(s) : Institute.  
Investigator(s) : Satyanarayana Rao, B.A. and others.  
Description : Malting studies were carried out on barley and ragi (Poorna variety) and possibility of using ragi as adjunct was tried. The maximum quality of ragi that could replace barley in preparation of wort were determined as also the character of wort and the quality of fermented brew. Malt based syrups using barley and maize were prepared and reconstituted to the worts of original specific gravity and characters were determined. They were also fermented and characters were determined.
- Report(s) : Final  
Papers Published : 1. Satyanarayana Rao, B.A. and others. Laboratory trials on brewing using barley grain, deformed maize and industrial enzymes. J. Food Sci. Technol. 14(6); 1977; 277  
2. Venkatanarayana, S. and others. Use of ragi (Eleusine coracana) in brewing. J. Food Sci. Technol. 16(5); 1979; 204
- \*277

### Pulses

- 349 Project Title : Studies on legumes.  
Organisation : Nagpur University; Laxminarayan Institute of Technology, Nagpur-440 110.  
Project Category : Fundamental and Applied.  
Cost : -  
Duration : 1975-  
Sponsor(s) : University.  
Investigator(s) : Rao, B.Y. and others.  
Description : Incorporation of green gram, black gram and others neglected in bakery products is being studied. The legumes are subjected to germination, and amylase and proteases are studied. The grains are then puffed and the changes in carbohydrate and protein constituents are investigated. Investigations on lipoxidase and isoenzymes, which cause off flavour and bleaching of chlorophyll and carotenes, are also being conducted.
- Report(s) : -  
Papers Published : 1. Bhandari, B. and Rao, B.Y. Amino acid of fractions of black gram dhal (Phaseolus mungo). Philippine J. Sci. 106; 1977; 165  
2. Bhandari, B. and Rao, B.Y. Incorporation of black gram flour in bread. Beverage and Food World 3; 1978; 9

3. Daru, J.J. and others. Studies on formulation of fruit toffee with bengal gram flour. Indian Food Packer. 33; 1979; 15.
4. Meshram, J.R. and others. Studies on parched mothbeans. Indian J. of Nutr. Diet. 17; 1980; 211
5. Rao, B.Y. and others. Incorporation of green gram flour in bread. Indian Baker. 6; 1976; 31.
6. Rao, B.Y. and others. Amino acid fractions of green gram dhal. Chem. Petrochem. J. 8; 1977; 15

- 350 Project Title : Studies on production pattern and processing methodologies of common pulses in the Punjab and Haryana, Uttar Pradesh, Madhya Pradesh, Vidarbha region of Maharashtra and Andhra Pradesh to identify main difficulties and initiate suitable remedial measures.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Rice and Pulse Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 9,90,000/-
- Duration : July 1982-June 1986.
- Sponsor(s) : Institute.
- Investigator(s) : Rama, B.L. and others.
- Description : Information is being collected from various agencies in the state of Punjab, Haryana and Rajasthan on the production pattern and processing technologies adopted for milling of major and minor pulses in different regions with a view to identify the technological problems and gaps. A survey of the pulse milling industry in Ludhiana showed that the millers are using the traditional methods involving conditioning, sundrying and splitting the pulses. Bengal gram dal and to some extent tur dhal and besan (bengal gram flour) are chief products of dal milling at Ludhiana. The common problems identified were the lack of proper control in conditioning operation and the laborious process of sun-drying.
- Report(s) : -
- Papers Published : -
- 351 Project Title : Studies on improving the primary processing (milling and puffing) techniques with special reference to small scale sector.
- Organisation : Central Food Technological Research Institute; Rice and Pulse Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 3,38,250/-.
- Duration : April 1980-March 1983.
- Sponsor(s) : CSIR
- Investigator(s) : Kurien, P.P. and others.
- Description : The objectives of the project are to: (1) develop optimum pre-processing treatments for pulses before milling; (2) modernise traditional small scale machine like hand operated chakki or power-operated dehulling-cum-splitting machines commonly used at the village level; (3) develop optimum processing techniques for less known and cheaper pulses; and (4) optimise processing conditions for better quality and yield from bengal gram and other similar pulses. Investigations have already been conducted on puffing of pulses, dry grinding of dhal and varietal differences in milling characteristics. Several lesser known pulses were identified and suitable processing techniques developed. They included moth-bean (Phaseolus aconitifolius Jac.), Vatana (Pisum sativum), chavli (Vigna catjang)



winged bean (*Tetragonolobus purpureus*) and horse gram (*Dolichos biflorus*). A survey of the small scale processing of pulses to primary products like dhal, puffed pulses and besan (gram flour) in Maharashtra, Madhya Pradesh and Tamil Nadu was also conducted. The survey is continuing in other areas.

Report(s) : -

Papers Published : 1. Kurien, P.P. Processing of pulses in India. Presented at Workshop on Grain Legumes, New Delhi, January 1981.  
2. Kurien, P.P. Varietal variations in the milling characteristics of pigeon pea. Presented at International Workshop on pigeon peas, ICRISAT, Patancheru, Andhra Pradesh, December 1980.

352 Project Title : Milling of pulses.  
Organisation : Govind Ballabh Pant University of Agriculture and Technology, Pantnagar 263 145; Agriculture Engineering Department.  
Project Category : Fundamental, Applied and Survey.  
Cost : Rs. 1,37,000/-.  
Duration : August 1978-July 1981.  
Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
Investigator(s) : Singh, B.P.N.; Narain, M.  
\*313

353 Project Title : Studies on the varietal differences on the milling characteristics of commercial and newly evolved varieties of pulses.  
Organisation : Central Food Technological Research Institute, Mysore-570013; Rice and Pulse Technology Discipline.  
Project Category : Fundamental and applied.  
Cost : Rs. 1,86,200/-.  
Duration : February 1978-December 1980.  
Sponsor(s) : Institute.  
Investigator(s) : Kurien, P.P.; Ramakrishnaiah, N.  
Description : Sixteen pure strains and two commercial varieties of tur pulse were screened for their milling characteristics as influenced by variety. Only three varieties (ICP 72228, ICP 7182 and T-21) were found to have good dehushing behaviour (90-99% dehushing) under conditions employed (heating at 120 C and tempering four times). With yields of 78.6 to 79.2% of dhal/pearled pulses. Techniques were developed for milling of winged bean, guar seed and cowpea. The technique for dehulling winged bean consisted of oil treating the size-graded grains which are then split, conditioned and dehulled in abrasion mill. Methods have also been developed for cowpea and horsegram on similar lines.  
Report(s) : Final.  
Papers Published : 1. Kurien, P.P. Processing of pulses in India. Presented at Workshop on Grain Legumes, New Delhi, January 1981.  
\*314

354 Project Title : Studies on pulse milling technology in India.  
Organisation : Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal-460010.  
Project Category : Survey  
Cost : -  
Duration : 1979-  
Sponsor(s) : ICAR  
Investigator(s) : Karsoliya, R.P.  
Description : The project was initiated with the objectives of surveying the dhal mills in regard to technical and managerial aspects and suggest improvements for better dhal, recovery. The survey of dhal mills located at Itarsi, Pipariya, Bodarwaria, Kareli

and Narasingpur of MP. revealed that losses to the extent of 10-16% occurred in pulse milling due to improper cleaning and conditioning prior to milling. The average recovery of dhal from Bengal gram, pigeon pea, green gram, black gram, lentil and lathyrus was respectively 73, 71, 65, 71, 76 and 76%. It was found that breakage percentage of dhal can be reduced and recovery increased if the pulses are properly conditioned and dried before milling. The studies are in progress.

Report(s) : -

Papers Published : -

355 Project Title : Preparation of protein concentrates and protein isolates and their characterisation from Phaeolus vulgaris and other legumes.

Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani; 431 402; Department of Food Science and Technology.

Project Category : Applied.

Cost : Rs. 1,50,000/-.

Duration : June 1981-June 1984.

Sponsor(s) : University and Government of Maharashtra.

Investigator(s) : Chavan, J.K. and others.

Description : Detailed investigations are being carried out to produce protein concentrates and isolates from various legumes which include: (a) optimum conditions for extraction of proteins (b) isoelectric focussing of proteins (c) electrophoretic characterisation, (d) determination of molecular weights and subunit structure, (e) aminoacid spectrum and digestibility, (f) protease inhibitors and their activities and (g) functional properties of isolates and concentrates.

Report(s) : -

Papers Published : -

356 Project Title : Protein enriched formulations from local legumes and cereals.

Organisation : Regional Research Laboratory Canal Road, Jammu Tawi 180 001;

Project Category : Applied.

Cost : Rs. 62,500/-.

Duration : July 1976-December 1982.

Sponsor(s) : Laboratory.

Investigator(s) : Dang, R.L. and others.

\*315

357 Project Title : Studies on protein with special reference to functional and nutritional properties from cereals and legumes: (a) wheat proteins, (b) enzyme inhibitors, haemagglutinins/lectins from legumes.

Organisation : Central Food Technological Research Institute, Mysore-570013;

Project Category : Applied.

Cost : Rs. 2,82,500/-.

Duration : April 1980-March 1983.

Sponsor(s) : CSIR

Investigator(s) : Nigam, S.N. and others.

Description : Wheat proteins: Chromatographic studies of gliadins and glutenins have indicated that (i) both have similar elution volumes (Sepharose 4B) when the eluent is of moderate dissociating strength (1M AcOH-GuHCl). The elution volume under these conditions is a varietal characteristic and is related to aminoacid composition of gliadin and glutenins. (ii) SDS-PAGE pattern of reduced and oxidised glutenins (K65) though similar,



are not identical. Some of the small MW proteins formed retain their capacity to associate (iii) About 16% of the K65 glutenin protein is bound to the complex by non-covalent binding. (iv) K65 gliadin has a glutenin like protein and the gliadin itself is made of atleast 3 types of proteins as shown by their behaviour in GuHCl.

**Haemagglutins and lectins:** The lectins isolated from both varieties, viz. typrius (lab lab bean) and lignosus (field bean) were oligomeric glycoproteins (MW 92500±4000) possibly made of similar subunits. The carbohydrate content was mostly mannose and N-acetyl glutamine. The amino acid composition of both was similar and methionine and half cystine could not be detected. Alanine and serine were the only N and C terminal amino-acids for both the lectins. Among a number of sugars, D-glucose and D-mannose inhibited the haemagglutinating activity of the lectins. The lectins were antigenically similar but the antisera did not react with other glucose/mannose specific lectins.

**Enzyme inhibitors of legumes:** The tryptic/chymotryptic inhibitor of field bean was purified and its specific activity was found comparable to that of soybean tryptic inhibitor. The purified inhibitor showed three components, all with tryptic inhibitor activity, but one with chymotryptic activity, also.

Report(s) : -

Papers Published : 1. Hariharan, K. and Rajagopal Rao, D. Nature of lectin from Dolichos lab lab. Presented at Annual Meeting of Society of Biological Chemists (India), Bangalore, December 1980.

358 Project Title : Chemical and biochemical studies on lipids of legumes and cereals.

Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition Discipline.

Project Category : Fundamental.

Cost : Rs. 1,25,700/-.

Duration : July 1976-April 1979.

Sponsor(s) : CSIR

Investigator(s) : Mahadevappa, V.G. and others.

Description : Studies were conducted on lipids of several varieties of millets and pulses. The major part of the finger millet lipids comprised of natural lipids (70-72%), mainly triglycerides. Cowpea also contained neutral lipids the extent of 68%. Four sterols were isolated from neutral glycolipid fractions of finger millets and cow pea, purified and quantified. These slightly differed in their properties. The major glycolipids were MDGD (0.155% finger millet and 0.032% in cow pea) and DGDG (0.010% in finger millet and 0.060% in cow pea). Their fatty acid compositions were also determined. Phosphatidyl choline and P-ethanoalanine were the major phospholipids in finger millet 57-60% and 16-18% respectively) and cow pea (40% and 20% respectively). Also detected were PA, PG and PI in finger millet and PC and PZ in cow pea. Rat feeding studies were also conducted to determine the effect of finger millet of cowpea lipids on hypercholesterolemia and body lipogenesis. Cowpea lipid had more capacity to lower cholesterol than finger millet lipid. Both lipids had no effect on body lipogenesis.

Report(s) : Final.

Papers Published : 1. Mahadevappa, V.G. and Rama, P.L. Chemical and biochemical studies on lipase of ragi (Eleusine coracana). Presented at symposium on production, processing and utilisation of maize, sorghum and millets. Mysore, 1976.

2. Mahadevappa, V.G. and Raina, P.L. Chemical studies on lipids of millets. Presented at Annual Meeting of Society of Biological Chemists (India) Madras, September 22-25, 1977.
3. Mahadevappa, V.G. and Raina, P.L. Lipid profile and fatty acid composition of finger millet (Eleusine coracana). J. Food Sci. Technol. 15(3); 1978; 100.
4. Mahadevappa, V.G. and Raina, P.L. Nature of some Indian legume lipids. J. Agric. Food Chem. 28(5); 1978; 1241
5. Mahadevappa, V.G. and Raina, P.L. Sterol lipids in finger lipid (Eleusine coracana). J. Amer. Oil Chem. Soc. 55; 1978; 697
6. Mahadevappa, V.G. and Raina, P.L. Sterols, esterified sterols and glycosylated sterols of cow pea lipid (Vigna unguiculata). J. Agric. Food Chem. 26; 1981; 1225.

- 359 Project Title : Effect of sprouting on the nutritional functionality of grain legumes.
- Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani- 431 402; Department of Food Science and Technology.
- Project Category : Applied.
- Cost : Rs. 50,000/-.
- Duration : June 1981-June 1983.
- Sponsor(s) : University and Government of Maharashtra.
- Investigator(s) : Chavan, J.K. and Jadhav, S.J.
- Description : The project is concerned with (a) assessment of nutrient composition, (b) changes in starch, sugars and protein and (c) protein digestibility before and after cooking. The study will include local beans like horse gram and moth bean and currently nutrient analysis is in progress.
- Report(s) : -
- Papers Published: : -
- 360 Project Title : Evaluation of protein quality and nutritional composition of pulses/cereals.
- Organisation : Mahatma Phule Krishi Vidyapeeth, Rahuri 413 722; Agricultural Chemistry and Soil Science Department.
- Project Category : Applied.
- Cost : Rs. 50,000/-.
- Duration : 1972-1982.
- Sponsor(s) : Vidyapeeth.
- Investigator(s) : Desai, B.B. and others.
- \* 117
- 361 Project Title : Loss of certain nutrients due to different methods of cooking in pulses, vegetables and fruits in India.
- Organisation : Andhra Pradesh Agricultural University; College of Home Science, Saifabad, Hyderabad 500 004.
- Project Category : Applied and Survey.
- Cost : Rs. 1,00,000/-.
- Duration : 1978-1980.
- Sponsor(s) : International Foundation of Science.
- Investigator(s) : Pushpamma, P. and others.
- \*319
- 362 Project Title : Biochemical studies on pulses (bengal gram) stored in different types of indigenous and improved storage structures.
- Organisation : Jawaharlal Nehru Krishi Vishwa Vidyalaya; College of Agricultural Engineering, Jabalpur 482 004.



Project Category : Applied.  
 Cost : -  
 Duration : September 1976-December 1979.  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Gupta, D.P. and others.  
 \*325

- 363 Project Title : Effect of chemical treatments on the cooking and nutritional quality of legumes.  
 Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani 431 402; Department of Food Science and Technology.  
 Project Category : Applied.  
 Cost : Rs. 70,000/-.  
 Duration : June 1980-June 1980.  
 Sponsor(s) : University and Government of Maharashtra.  
 Investigator(s) : Chavan, J.K. and others.  
 Description : The project is concerned with developing a chemical process for reducing the cooking time of whole beans and dhal and improving the digestibility of the legumes. Functional properties of soaked and cooked beans are also being studied.  
 Report(s) : -  
 Papers Published : 1. Kadam, S.S. and others. Improvement in cooking quality of horse gram by pre-soaking treatment with salt solution. Qual. Plant Plant. Foods for Man. 31(2); 1981; 171.  
 2. Satwadhar, P.N. and others. Effect of germination and cooking on polyphenols and in vitro protein digestibility of horse gram and moth bean. Qual. Plant. Plant. foods for Man. 31(1); 1981; 71
- 364 Project Title : Trace element composition of decorticated pulses (dhals).  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad-500 007.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : Decorticated bengal gram (Cicer arietenum), red gram (Cajanus cajan) and green gram (Phaseolus radiatus) were investigated. Bengal gram and red gram dhals were similar in mineral composition to whole grains. These dhals contributed very little to Ca, Zn and Cr contents of the whole grain suggesting that the seed coat and germ part were considerably richer sources of these minerals. On the other hand, green gram dhal, most of the minerals, except Mn, were retained in the dhal itself.  
 Report(s) : Annual  
 Papers Published : 1. Udayasekhara Rao, P. and Bhavani Belavady. Chemical composition of high yielding pulses: varietal, locational year to year differences. Indian J. Nutr. Diet. 16; 1979; 440
- 365 Project Title : Flatulence factors in irradiated legumes.  
 Organisation : Bhabha Atomic Research Centre, Bombay 470 085.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Sudha Rao, V.; Vakil, U.K.  
 Description : The quantity of non-reducing oligosaccharides in legumes, identified as flatulents, can be minimized by their rapid breakdown to easily digestible sugars by radiation treatment (1 to 10 kGy)

and/or by combination with other conventional food processing methods. Radiolytic breakdown products are similar to those produced by enzymic hydrolysis of these sugars (such as raffinose, stachyose, verbescose) by purified alpha galactosidase.

- Report(s) : -  
Papers Published : -
- 366 Project Title : Hypocholesterolemic activity of some uncommon pulses.  
Organisation : National Institute of Nutrition, Tarnaka, Hyderabad - 500 007.  
Project Category : Fund.  
Cost : -  
Duration : -  
Sponsor : ICMR  
Investigator(s) : -  
Description : Cholesterol lowering activities of Goa bean (*Psophocarpus tetragonolobus*), rajmah (*Phaseolus vulgaris*) and Kesari dhal (*Lathyrus sativus*) were studied by feeding albino rats with diets substituted in place of casein and starch by defatted powders of these pulses, and of soya bean and Bengal gram. The diets were isocaloric with 15% protein and were given cooked form. Blood withdrawn by cardiac puncture after 4 weeks of dietary regimen was analysed for total cholesterol, lipid phosphorous and triglycerides. Results showed that addition of kesari dhal, soyabean and Bengal gram to the basal diet resulted in lowering of serum cholesterol while rajmah and goa bean did not show any such effect. In the case of soyabean and kesari dhal, the reduction of total cholesterol, was mainly in the ester fraction while with Bengal gram the reduction was in both free and ester cholesterol fractions. Lipid phosphorus was reduced only when soya bean was added. None of the pulses except Bengal gram reduced serum triglyceride levels.
- Report(s) : Annual  
Papers Published: -
- 367 Project Title : Recipe development of unconventional cereals and pulses.  
Organisation : Food Craft Institute, Shivajinagar, Pune 411 005.  
Project Category : Applied.  
Cost : Rs. 1,000/-.  
Duration : 1982-1983.  
Sponsor(s) : Institute.  
Investigator(s) : Gangolli, V.A. and others.  
Description : Incorporation of uncommon pulses like horsegram, and cereals like ragi into acceptable recipes is being investigated.
- Report(s) : -  
Papers Published : -
- 368 Project Title : Estimation of quantitative and qualitative losses in stored pulses damaged by *Callosobruchus* spp.  
Organisation : Indian Grain Storage Institute, P.B.No.10, Hapur 245 101.  
Project Category : Applied.  
Cost : -  
Duration : 1980-1983.  
Sponsor(s) : Government of India, Ministry of Agriculture, Department of food.  
Investigator(s) : Varma, B.K. and others.  
Description : Estimation of quantitative and qualitative losses in green gram, black gram and pigeon pea, damaged by *Callosobruchus chinensis* is being attempted.
- Report(s) : -  
Papers Published : -



369 Project Title : Cooking quality of irradiated legumes.  
 Organisation : Bhabha Atomic Research Centre, Bombay 470 085.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Sudha Rao, V.; Vakil, U.K.  
 Description : Cooking time of various legumes, gamma-irradiated at 0.5 to 5 kGy dose levels, is reduced at a function of dose. Similarly, observed low gelatinization viscosity of the irradiated legume flour indicates the lesser degree of association or starch molecules due to their fragmentation by radiation treatment. The textural improvement in terms of softness (measured by Instron), results in increased consumer's acceptability of cooked legumes, irradiated upto 2.5 kGy.

### Bengal Gram

370 Project Title : Effect of production practices on post-harvest characteristics of bengal gram.  
 Organisation : Punjab Rao Krishi Vidyapeeth, Akola 444 104; Harvest and Post  
 Project Category : Applied.  
 Cost : Rs. 60,000/-.  
 Duration : 1980-1983  
 Sponsor(s) : Indian Council of Agricultural Research and Government of Maharashtra.  
 Investigator(s) : Paturde, J.T.; Umbarkar, S.P.  
 Description : The effects of production practices on threshing, milling, etc. of bengal gram are being studied.  
 Report(s) : Annual Report 1980.  
 Papers Published : -

371 Project Title : Effect of salinity on lipid components of bengal gram.  
 Organisation : Haryana Agricultural University, Hissar 125 004; Chemistry and Biochemistry Department.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1976-1979.  
 Sponsor(s) : University.  
 Investigator(s) : Wagle, D.S.; Gupta, K.  
 \*331

372 Project Title : Hypocholesterolemic activity of hydroxy acids in Bengal gram.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : It was observed earlier that addition of p-coumaric acid (a precursor of isoflavones) to diets brought down serum cholesterol levels in rats. Studies were therefore extended to find out whether the other hydroxy acids (aliphatic and phenolic) present in Bengal gram had similar hypocholesterolemic activity. It was found that supplementation of phenolic acids like vanillic, caffeic and cinnamic acids to diets slightly reduced serum cholesterol though the fall was not significant. On the other hand, ferulic acid and p-coumaric acid significantly

reduced cholesterol levels. The latter also significantly reduced LDL and VLDL fractions of cholesterol. Triglyceride and lipid phosphorus levels, however, were not altered. With the addition of phytic acid there was a significant depression of total cholesterol, triglyceride and the LDL and VLDL cholesterol fractions. Uronic acid reduced both total cholesterol and triglycerides but did not alter lipid phosphorus. It also significantly lowered LDL and VLDL but elevated (though not significantly) the HDL cholesterol content. The hypocholesterolemic effect of these phenolic acids was attributed to the presence of an OH and -CH=CH-COOH groups together in their molecules. This activity was possibly potentiated by methoxylation at the ortho position. The hypocholesterolemic activity of the hydroxy acids was also evident in cases of rats with induced hypercholesterolemia irrespective of the method used to induce the condition. The overall data suggest that several hypocholesterolemia factors are present in Bengal gram apart from isoflavones. The fibre content is important in that the lignin is known to contain p-coumaric and ferulic acids. So also the non cellulosic polysaccharides abundantly found in legumes, which contain the uronic acid.

Report(s) : Annual.

Papers Published : 1. Sharma, R.D. Effect of hydroxy acids on hypercholesterolaemia in rats. *Atherosclerosis*. 37; 1980; 463

- 373 Project Title : Isoflavone content of Bengal gram.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : Earlier, it was found that the two isoflavones biochanin A and formononetin isolated from germinating Bengal gram had hypocholesterolemic activity in rats. These compounds were not found in dormant seeds but only appeared on germination. Bengal gram on germination was found to contain four isoflavones the above two and daiozein and pratensein. All these compounds increased with duration of germination the extent of increase being more marked after 96 hours. Wide variations in both total isoflavone content and profile existed among the varieties studied (CPS<sub>2</sub>, JG6<sub>2</sub>, Jyoti, Annegiri). Cooking the germinated seeds for 10 minutes in a pressure cooker under 15 lb pressure reduced the formononetin and biochantin contents by 54 and 50% respectively indicating that these compounds were heat labile.

Report(s) : Annual.

Papers Published : 1. Sharma, R.D. Effect of various isoflavones on lipid levels in triton-treated rats. *Atherosclerosis*. 33; 1979; 371.  
 2. Sharma, R.D. Isoflavones and hypercholesterolemia in rats. *Lipids*. 14; 1979; 535.

#### Red Gram

- 374 Project Title : Storage studies on pigeon pea and bengal gram.  
 Organisation : Punjab Rao Krishi Vidyapeeth, Akola - 444 104; Harvest and Post-harvest Technology Scheme.  
 Project Category : Applied.  
 Cost : Rs.85,090/-.  
 Duration : 1980-1983.



- Sponsor(s) : Indian Council of Agricultural Research and Government of Maharashtra.
- Investigator(s) : Umbarkar, S.P. and others.
- Description : The project attempts to find out the best storage structure for pigeon pea.
- Report(s) : Annual Report 1980.
- Papers Published : -
- 375 Project Title : Effect of household processing on mineral and tannin content of red gram.
- Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 570 007.
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : ICMR
- Investigator(s) : -
- Description : Effects of household processing methods such as soaking, cooking and germination on the nutrient mineral and the antinutritional factors like tannins and phytates were investigated in six varieties of red gram. Results showed that losses in minerals and trace elements varied for different elements; Ca losses in total P, phytin P, Cu and Zn were marginal and losses Ca, Mg and Mn were appreciable. Reduction in ash content ranged from 13-30%. Phytin P constituted nearly 65% of total P. Expressed as % of total P, phytin P was not appreciably altered during germination or cooking after germination. On the other hand, with raw pulse there appeared to be some increase in % phytin P, the reason for which was not clear. Unlike in mineral element, the varietal differences in tannin content were significant. Germination gradually decreased tannin content the % decrease increasing with germination time (0-48 hours) from 22-39%. The decrease with cooking was more significant (40%) than with either soaking or germination.
- Report(s) : Annual.
- Papers Published : -
- 376 Project Title : Anti-tryptic activity in pigeon pea and goa bean.
- Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : ICMR
- Investigator(s) : -
- Description : The presence of fair amounts of trypsin inhibitor was shown earliest in some newly evolved varieties of Lathyrus sativus and soyabean. Some physico-chemical characteristics of L. sativus were also studied and 5 active proteins were isolated by column chromatography. The studies were continued with 10 newly evolved varieties of pigeon pea, three sample of processed and unprocessed soybean and two varieties of Goa bean. The total protein contents in different varieties of pigeon pea) ranged from 20.6 to 22.8% and 1.60 to 2.7% respectively. The antitryptic activity in water extracts and buffer extracts (expressed as specific activity) ranged from 92 to 195 units and 51 to 180 units respectively in the 10 varieties studied. These activities were comparatively higher in the new varieties than in the pedigree varieties. Compared to antitryptic activity of soybean and L. sativus, that of pigeon pea was much less (i.e. it had much less fraction of anti-proteolytic protein). It was also observed that, in Bragg variety soybean,

the antitryptic factor which was present to the extent of 41.3 units (in raw sample) could be completely destroyed by dry or wet roasting. But, the trypsin inhibitory activity of Goa bean was less sensitive to this treatment. The two varieties of Goa bean (EC 38958 and IC 17004) lost only 12% of activity on baking in water for 30 minutes. Boiling for 60 minutes resulted in 60% destruction in var. EC 38958 and 100% destruction in var. IC 17004. Auto claving at 15 lb for 15 minutes resulted in complete destruction of the antitryptic factor. When the seeds were decoated and powdered before boiling, nearly 90% of the activity was lost within 15 minutes.

Report(s) : Annual.

Papers Published : - Double bean

377 Project Title : Studies on trypsin inhibitors for double bean and field bean.  
 Organisation : Institute of Science, 15 Madame Cama Road, Bombay 400 032.  
 Project Category : Fundamental.  
 Cost : -  
 Duration : September 1976-December 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Inamdar, A.N.; Chebbi, A.V.  
 \*336

#### Peas

378 Project Title : Canning of vegetable peas.  
 Organisation : Rajendra Agricultural University; Bihar Agricultural College, Sabour, Bihar; Fruit preservation laboratory.  
 Project Category : Applied and Exploratory.  
 Cost : -  
 Duration : December 1976-December 1981.  
 Sponsor(s) : Singh, R.K. and others.  
 \*327

#### Cowpea

379 Project Title : Nutritional qualities of cowpea.  
 Organisation : University of Agricultural Sciences; College of Agriculture, Dharwar 580 005; Department of Agricultural Botany.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979-1982.  
 Sponsor(s) : University of Agricultural Sciences.  
 Investigator(s) : Goud, J.V.; Meera Rao.  
 Description : The nutritional qualities and acceptability of cowpea as a vegetable and as a grain legume are being investigated by chemical and organoleptic tests.  
 Report(s) : -  
 Papers Published : 1. Hanchinal, R.R. and others. Acceptability of different cowpea varieties as a vegetable. Mysore J. Agric.Sci. 12(3); 1978; 367.

380 Project Title : Effect of unavailable carbohydrates and some chemicals on cooking characteristics of cowpea and lentil.  
 Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani-431 402; Department of Nutrition and Biochemistry.



Project Category : Applied.  
 Cost : Rs. 20,000/-.  
 Duration : August 1981-July 1984.  
 Sponsor(s) : University and Government of Maharashtra.  
 Investigator(s) : Powar, V.D. and others.  
 Description : The project aim at improving cooking characteristics of cow pea and lentil dhals with or without unavailable carbohydrates by the addition of chemicals.  
 Report(s) : -  
 Papers Published : -

### Blackgram

381 Project Title : Protein fractionation in blackgram.  
 Organisation : Tamil Nadu Agricultural University, Agricultural College and Research Institute, Coimbatore 641 003; Biochemistry Department.  
 Project Category : Applied.  
 Cost : Rs. 12,000/-.  
 Duration : September 1979-August 1981.  
 Sponsor(s) : University.  
 Investigator(s) : Krishnaveni, S.  
 Description : The project has the objective of identifying blackgram varieties with high protein quality. It involves: (i) Screening of gum plasm collection for total protein, (ii) fractionating the total protein on the solubility basis, and (iii) gel electrophoresis of the fractionated proteins.  
 Report(s) : -  
 Papers Published: : -

382 Project Title : Trace element composition of blackgrams.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad - 500 007.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : This study is an extension of the project on the trace element composition of decorticated pulses (See project 431). Dhal prepared from whole grains of variation of blackgram by manual decortication and degerming was analysed. Results showed that the dhal (cotyledons) as compared to whole grains were relatively poor in Ca and P content. This suggested that the seed coat and germ part were considerably richer in these minerals. On the otherhand, the various trace elements were largely retained in the cotyledons. Thus it could be concluded that decortication, by and large, seemed to conserve the trace elements while causing a loss in Ca and P contents.  
 Report(s) : Annual.  
 Papers Published : -

### Winged bean

383 Project Title : Biochemical changes in winged bean during grain development.  
 Organisation : Mahatma Phule Agricultural University, Rahuri, Dist. Ahmednagar, Maharashtra; Department of Food Science and Technology.  
 Project Category : Fundamental and Applied.  
 Cost : Rs. 1,20,000/-.

Duration : June 1981-June 1984.  
 Sponsor(s) : Government of Maharashtra.  
 Investigator(s) : Kadam, S.S.; Lawande, K.M.  
 Description : The project aims to study the changes in biochemical and nutritional properties of food components of winged bean at different stages of maturity.  
 Report(s) : -  
 Papers Published: -

### Bean

384 Project Title : Extraction of leaf protein.  
 Organisation : University of Agricultural Sciences, Bangalore 560 024; Chemistry and Soils Department.  
 Project Category : Fundamental and Applied.  
 Cost :  
 Duration : 1972-.  
 Sponsor(s) : University.  
 Investigator(s) : Serur, N.G. and others.  
 \*337

385 Project Title : Studies on a) enzyme inhibitors (tryptic/chymotryptic) from legumes with special reference to field bean (Dolichos lab lab); b) lectins from the genus Dolichos.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 1,74,000/-.  
 Duration : April 1980-April 1983.  
 Sponsor(s) : Institute.  
 Investigator(s) : Rajagopala Rao, D. and others.  
 Description : An active tryptic/chymotryptic inhibitor was isolated from phosphate buffer saline extracts of field bean by a combination of heat treatment, isoelectric precipitation, acetone fractionation and gel filtration on Sephadex G-75. The activity of the inhibitor was tested with human pancreatic abstracts and it was found that greater quantities of the inhibitor was needed as compared to bovine trypsin/chymotrypsin. Lectins from 2 varieties of Dolichos lab lab were purified from saline extracts of the seeds by ammonium sulphate fraction, affinity chromatography on mannose linked Sepharose-6B columns. The lectin was specifically eluted with mannose or glucose. D. lab lab var. typicus lectin resembled the field bean lectin. The molecular weight of the typicus lectin was about 91,000 and seemed to consist of subunits. The purified typicus lectin seemed to be a glycoprotein and has similar biological properties like lectin from Dolichos lab lab var. lignosus.  
 Report(s) : -  
 Papers Published : -

### Soyabean

386 Project Title : Prospects of soybean utilisation in Indian human diets: Biochemical, nutritional and technological aspects.  
 Organisation : Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur-482 004; Faculty of Agriculture; Department of Food Science.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 40,000/per annum.  
 Duration : February 1973-.



Sponsor(s) : ICAR

Investigator(s) : Gupta, A.K.

Description : This project is an integral part of All India Coordinated Research Project on Soybean of Indian Council of Agricultural Research. The objectives are: (a) Chemical and biological analysis of soybean and its products, (b) Evolution of new products both at pilot and household level (c) Popularisation of low cost soybean based foods and beverages among the masses (d) Consumer acceptance studies (e) Development of a Soybean Foods Research Centre at Jabalpur. Madhya Pradesh, having been declared as a Soybean State by the Government of India, has now a soybean industry of considerable magnitude. During recent years, therefore, considerable work has been carried out to develop soy-based products and recipes. These products have been evaluated chemically, nutritionally and organoleptically leading to their increasing acceptance by the people. Considerable effort has been expended to spread the knowledge about the value of these products among the people. In view of the emergence of soybean industry as a reality in the State, it has been proposed to establish a separate institute entitled Soybean Foods Research Centre on a permanent basis to cater to the needs of the state in respect of quality analysis, quality control and product formulation work.

Report(s) : 12 annual and other reports.

Papers Published : 1. Gupta, A.K.; Deodhar, A.D. Variation in trypsin inhibitor activity in soybean (Glycine max. L. Merrill). Indian J. of Nutr. and Diet. 12; 1975; 81

2. Gupta, A.K. and others. Some chemical and cooking characteristics of vegetable and grain type soybeans. J. of Food Sci. and Tech. 13(3); 1976; 133

3. Gupta, A.K. and others. Protein quality and digestibility in vitro of vegetable and grain type soybeans. Ind. J. of Nutr. and Diet. 13; 1976; 244

4. Dalal, M.A. and others. Variability and correlation studies on cooking quality of soybean. JNKV Res. J. (In press).

5. Kapoor, M. and others. Sensory evaluation of vegetable cutlets prepared from soybeans (vegetables and grain type) and potatoes. Curr. Agri. 1(3); 1977; 49

6. Gupta, D.P. and others. Nutritive value, trypsin inhibitor activity, in vitro digestibility and consumer acceptability of parched soybeans. J. of Food and Tech. (under publn.)

7. Gupta, D.P. and others. Effect of mixing soyflour with wheat flour on the keeping quality of blend during storage. Ind. J. of Nutr. and Diet. 14; 1977; 198.

8. Gupta, D.P.; Gupta, A.K. Biochemical evaluation and cooking quality of some soybean varieties grown at different locations of M.P. Curr. Agri. 1(4); 1977; 49.

9. Gupta, D.P.; Gupta, A.K. Amino acids and protein fractions of some soybean varieties grown at different locations of MP. Curr. Agri. 23(3&4); 1978

10. Singh, N.; Gupta, A.K. Biochemical evaluation and cooking quality of some soybean varieties recommended for cultivation in North India. Food, Farm. and Agri. 8(6); 1976; 1

11. Sikke, K.C. and others. Comparative nutritive value amino acid content chemical composition and digestibility in vitro of vegetable and grain type soybeans. J. of Agri. & Food Chem., USA, 26; 1978; 312

12. Sharma, Y.K. and others. Short note on trypsin inhibitor activity in soybeans at different stages of development. Ind. J. of Ent. 36(1); 1974; 62

13. Gupta, A.K. and others. Variation in trypsin inhibitor (TI) activity in black soybean. Ind. J. of Nutr. & Diet. (under publication)
14. Mishra, A. and others. Variation in protein, oil and tryptophan contents in black soybean (Kalitur). Food Farm. & Agri. 9(8); 1978; 235

- 387 Project Title : Study in post harvest maturity of soybean and paddy.  
 Organisation : Jawaharlal Nehru Krishi Vishwa Vidyalaya; College of Agricultural Engineering, Jabalpur 482 004.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1976  
 Sponsor(s) : University.  
 Investigator(s) : Alam, A.; Gupta, S.K.  
 \*345
- 388 Project Title : Development of full-fat soy flour.  
 Organisation : Govind Ballabh Pant University of Agriculture and Technology, Pantnagar 263 145; Food Science and Technology Department.  
 Project Category : Applied.  
 Cost : Rs. 1,21,156/-.  
 Duration : October 1977-September 1980.  
 Sponsor(s) : University  
 Investigator(s) : Surjan Singh and others.  
 \*346
- 389 Project title : Soyflour utilisation.  
 Organisation : Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal 462 010.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980.  
 Sponsor(s) : ICAR  
 Investigator(s) : Gandhi, A.P.; Nerwani, M.M.  
 Description : Effects were made to evolve a technically feasible and economically viable technology for making full fat soy flour at the rural level. In the moist heat process, the beans were soaked in water containing 1% baking soda at room temperature for 4 hours cooked in boiling water for 20 minutes. The baking soda enabled elimination of beany flavour by inactivating lipoxygenase. The decuticled soybeans were then ground in mini burr mill. In the dry heat process, the beans were soaked in water containing baking soda (1%) for 1 hour at room temperature and roasted for 30-40 minutes in an aluminium pass. In both processes, the dehulling was carried out after sundrying of the processed beans. To enable easier dehulling, another improved process was tried wherein the dehulling and splitting operations were carried out using mini burr mill and winnowing. Locally available equipment for steaming, boiling, roasting, decuticling and grinding machine were tested. The full fat soy flour produced by the above three methods are now being studied for shelf life and organoleptic acceptability. The flour had initial FFA levels of 4.4-5.6 (acid values) with 2.2%-2.8% as oleic acid.  
 Report(s) : -  
 Papers Published : -
- 390 Project Title : Processing and acceptability of soybean.  
 Organisation : Kerala Agriculture University; College of Horticulture, Vellankkara, Trichur-680 654.



- Project Category : Applied.  
 Cost : Rs. 1,500/-.  
 Duration : 1979-1981.  
 Sponsor(s) : University.  
 Investigator(s) : Girija, K.A.; Indira, A.  
 Description : The project envisages the popularisation of soybean recipes to improve the use of soyabean as a food; and also to increase the utility of soyabean as a protein rich and cheaper food. The developed recipes have been standardized using soyabean milk, germinated soyabean, soya powder, whole cooked soyabean and soyabean ground paste.  
 Report(s) : -  
 Papers Published : -
- 391 Project Title : Integrated soybean processing and utilization studies on Kali tur and development of balanced food supplements and beverages.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Protein Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 11,63,000/-.  
 Duration : July 1982-June 1984.  
 Sponsor(s) : Institute.  
 Investigator(s) : Subramanian, N. and others.  
 Description : Kali tur, an indigenous variety of soybean grown largely in Madhya Pradesh was found to compare well with the yellow soybean with regard to chemical composition and amino acid make up of the protein. The solubility characteristics of the total proteins in different solvents such as water, 1M NaCl and 2% sodiumhexametaphosphate in the pH range 2-10 have been studied. The total proteins in the defatted meal have also been fractionated using different physico-chemical techniques. The major 11S fraction of the protein has been isolated and its properties are studied. Comparative studies on the organoleptic quality of soy milk preparations made from Kali tur and yellow soybean indicate that the latter yields a more acceptable product. The effect of optimal heat treatment of soy grits to yield a dry full fat flour base for making soy milk is under study. The development of soy enriched cereal food supplements have been initiated to prepare ready-to-eat type products such as 'roti'.  
 Report(s) : -  
 Papers Published : -
- 392 Project Title : Integrated processing of soyabean for use as food: 1. Processing of soyabean for tailored uses as a pulse.  
 Organisation : Central Food Technological Research Institute, Mysore-570 013; Rice and Pulse Technology Discipline.  
 Project category : Applied and fundamental.  
 Cost : Rs. 6,25,400/-.  
 Duration : June 1982-June 1985.  
 Sponsor(s) : Institute.  
 Investigator(s) : Desikachar, H.S.R. and others.  
 Description : The project has attempted to find out whether optimally processed soyabean are partially or completely substitute pulses like Bengal gram or black gram or green gram for making staple and snack dishes commonly used in India. Dehusked and split soya dhal prepared as per the process developed in the Institute, full fat soya dhal flour, solvent extracted soya dhal

flour and processed whole soya dhal flakes were used for the studies. Using optimally processed soya flakes along with rice semolina it has been found possible to prepare an unleavened steamed idli-like product (kadabu) having very good consumer acceptance. Good and acceptable dosa could be prepared by complete replacement of black gram dhal by soya dhal using rice and soya in proportion of 4:1. Fermentation should be restricted to 10 to 12 hours to get desired flavour, acidity and texture. Acceptable dhal, rasam and sambhar could be prepared by using either whole soya flour or solvent extracted soya flour after suitable heat processing. Mysore pak is also prepared by whole soya flour.

Report(s) : -  
Papers Published : -

393 Project Title : Studies on removal of beany flavour in soy milk.  
Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani- 431 402; Department of Food Science and Technology.  
Project Category : Applied.  
Cost : Rs. 10,000/-.  
Duration : 1980-1982.  
Sponsor(s) : University and Government of Maharashtra.  
Investigator(s) : Gunjal, B.B.  
Description : Factors contributing to beany flavour and effect of additives in soymilk on removal of flavour are being studied. Preparation of soy milk has been standardised and effect of various flavouring agents on the acceptability of soy milk have been studied. Currently, the factors responsible for beany flavour are being studied and passing of soy milk through a vacreator alongwith addition of various food additives to mask the off-flavour will be explored.

Report(s) : -  
Papers Published : -

### Oilseed

394 Project Title : Oilseeds utilisation research.  
Organisaton : Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur-482 004; Faculty of Agriculture; Department of Food Science.  
Project Category : Fundamental and applied.  
Cost : Rs. 40,000 per annum.  
Duration : June 1972 - continuing.  
Sponsor(s) : ICAR  
Investigator(s) : Gupta, A.K.; Mishra, A.  
Description : This project is an integral part of All India Coordinated Research Project on oilseeds of Indian Council of Agriculture, and aims at (a) regular screening of oilseeds for their oil content, (b) studies on the characteristics of oils of different oilseeds, and (c) utilisation of oilseed cakes for edible purposes. Earlier work involved analysis of various samples of oilseeds and these data have been used to evolve high yielding varieties in Madhya Pradesh. Besides continuing the analytical work to cover more varieties, work will be initiated on (a) studies on essential fatty acid profiles of oilseeds of Madhya Pradesh, and (b) biochemical evaluation of oilseed cakes of promising oilseeds of Madhya Pradesh.  
Report(s) : Annual Report.



- Papers Published : 1. Sharma, Y.K.; Deodhar, A.D. Chemical composition of sesame varieties of Madhya Pradesh (India). Iranian J. Agric. Res. 3(2); 1975; 59
2. Sharma, Y.K.; Mishra, A. Evaluation of deoiled niger cake for its nutritive value as cattle feed. J. Food, Farm. and Agric. 1978; 1978; 251
3. Sharma, Y.K. and others. Effect of seeding dates on the oil and protein content of some sunflower varieties. JNKVV Res. J. 12(1-4); 1978; 102
4. Singh, B.P. and others. Effect of infection on the oil and protein content. JNKVV Res. J. 12(1-4); 1978; 101

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- 395 Project Title : Storage studies on oil bearing seeds.
- Organisation : Cadbury India Limited, Cadbury House, Bhulabhai Desai Road, Bombay 400 026.
- Project Category : Fundamental.
- Cost : Rs. 1,50,000/-.
- Duration : December 1977-December 1980.
- Sponsor(s) : Company.
- Investigator(s) : Shenoy, R.D. and others.
- \*349

- 396 Project Title : Development studies on edible oilseed flours.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Protein Technology Discipline.
- Project Category : Fundamental.
- Cost : Rs. 10,62,000/-.
- Duration : April 1981-March 1984.
- Sponsor(s) : Institute.
- Investigator(s) : Narasinga Rao, M.S. and others.
- Description : Different treatments given to sunflower meal such as washing with acetone, ethanol, methanol and water at pH 5.0 had an effect on the available lysine content, fractional properties, and in vitro digestibility of the total proteins in sunflower. The major fraction of safflower protein was isolated to homogeneity and had a  $S_{20}$ , w value of 12.4 intrinsic viscosity of 0.037 dl/gm and a molecular weight of  $2.5 \pm 0.2 \times 10^5$ . Studies on the 10S protein fraction of poppy seeds indicated that it consisted predominantly of a periodic structure with about 5%  $\alpha$ -helix and 20%  $\beta$ -structure. Experiments to determine the protein efficiency ratio of winged bean flour was carried out, with weanling albino rats. Effect of partial proteolysis of winged bean flour with a protease from fungal origin A. oryzae on its functional properties was studied. Proteolysis showed no effect on the tannin of winged bean flour. Acetylation and succinylation of the meal caused nitrogen solubility in water and 1M NaCl to increase. Succinylation improved the emulsification capacity two fold. Acylation affected the foam capacity of winged bean flour and also its tannin content.

Report(s) : -

Papers Published : -

- 397 Project Title : Studies on inedible oilseed meals and seeds of tree origin.
- Organisation : Central Food Technological Research Institute, Mysore- 570 013;
- Project Category : Fundamental and applied.
- Cost : Rs. 9,92,000/-.
- Duration : April 1981-March 1985.
- Sponsor(s) : Institute.
- Investigator(s) : Narendra Singh and others.

## Description

Major proteins of linseed was isolated to homogeneity and its physico-chemical characteristics determined. It had  $S_{20}^W$  of 12S, intrinsic viscosity of 0.031 dl/g. It consisted of atleast 7 subunits. A procedure was standardized to isolate the high molecular weight proteins of cottonseed namely the 11S and 7S protein. The subunits of the 7S protein were isolated. The interaction of gossypol with bovine serum albumin (BSA), a model protein, was also studied. The protein binds gossypol through hydrophobic and hydrogen bonds. Nitrogen solubility characteristics and the functional properties of tamarind kernel meal (TKM) as affected by heat treatment was reported earlier. Further, studies indicated that the raw meal had appreciable proteolytic, trypsin inhibitor and hemagglutinating activities. These have implications on the storage and nutritional qualities of TKM. A glycoprotein containing 60% protein and 35% carbohydrates was obtained from TKM and NaCl extraction of total proteins and  $(NH_4)_2SO_4$  precipitation. The defatted Madhuca butyracea flour was shown to have insecticidal and fungicidal activity. A method was developed to remove saponins from Madhuca butyracea flour and a colorimetric method for quantitative estimation. The total proteins of Madhuca butyracea were studied for their physico-chemical properties.

Report(s) :

Papers Published :

1. Madhusudan, K.T. Studies on linseed proteins. Presented at Ahara 82: International Food Conference, Bangalore, May 1982.
2. Hanumantha Rao, K. and Subramanyan, N. Nitrogen solubility and functional properties of tamarind seed kernel proteins. Presented at National Symposium on Protein Foods and Feeds, Madras, April 1982.
3. Shanmugasundaram, T. and others. Detoxification and utilisation of defatted Madhuca butyracea flour. Presented at Annual Meeting of Society of Biological Chemists (India), Chandigarh, November, 1982.

398 Project Title :

Organisation :

Project Category :

Cost :

Duration :

Sponsor(s) :

Investigator(s) :

Description :

Mineral and trace element composition of oilseeds. National Institute of Nutrition, Tarnaka, Hyderabad 500 007. Applied. - - ICMR - Dried defatted samples of various oilseeds, (5 nos.) including coconut were studied for total ash, P, Mn, Ca, Fe, Zn, Mg, Cu Mo and Cr. Among them, gingelly seeds (6 varieties) had the highest content of all minerals except Mn. Coconut (9 varieties) was rich in Mn but poor in other minerals. Groundnut (19 varieties) was lowest in Fe, Zn and Mn; mustard (8 varieties) was lowest in Cu and safflower (6 varieties) was lowest in Mo and Cr. In groundnut there were significant (c.v. > 25%) varietal differences for Ca, Fe, Mn, Cu and Cu; in mustard for Mn, Mo and Cr; in safflower for Ca, Mo and Cr, in gingelly for Zn; and in coconut for Ca, Fe and Cu. In general, the oilseeds appeared to be rich sources of minerals and trace elements as compared to cereals particularly in Cr content. Groundnut, however, was a poor source of Fe.

Report(s) :

Papers Published :

: Annual.

: -



- 399 Project Title : Fatty acid composition of different varieties of oilseed.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad-500 007.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : Fat was extracted from various commonly used oilseeds using diethyl ether and soxhlet extraction procedure. With safflower oil, a chloroform; methanol (2:1 ratio) extraction was used to prevent loss of linoleic acid by oxidation. Methyl esters of the fatty acid prepared according to the method of Hubscher and others and analysed by GLC using polydiethylene glycol succinate as the stationary phase. It was found that oleic acid concentration ranged from 38.7-56.2% in 27 varieties of groundnut with a mean value of 47.9%. Linoleic acid was present to the extent of 29.9%. The range was 16.2-38.4%. In safflower oil, considered to be the richest source of linoleic acid, little varietal variation was noted in this fatty acid with the values ranging between 75 and 83% and a mean value of 78.5%. In mustard oil, the major fatty acid, erucic acid, fluctuated within a narrow range of 42-49% with an average value of 46.5%. Least amount of linoleic acid (0.8%) was found in coconut oil in which the largest share of fatty acid comprise the lower chain saturated fatty acids. The content of lauric acid was to the extent of 52%. Overall results indicate no significant varietal differences for any of the oilseeds studied. The mean values for various fatty acids were comparable to those of American origin indicating that the high yielding varieties retained the characteristic distribution of fatty acids.  
 Report(s) : Annual Report.  
 Papers Published : -
- 400 Project Title : Chemical and enzymatic modification of vegetable proteins.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition Discipline.  
 Project Category : Applied and fundamental.  
 Cost : Rs. 2,38,000/-.  
 Duration : January 1975-March 1981.  
 Sponsor(s) : CSIR  
 Investigator(s) : Raghavendra Rao, M.R.; Susheelamma, N.S.  
 Description : Studies were carried out to explore the possibilities to modify proteins from oilseed cakes by enzymes through plastein-type reaction to improve their nutritional value. Lysine fortification of groundnut protein indicated that tryptic and peptic hydrolysate of casein could be used as a source of lysine peptide. Tests with different combination of these hydrolysates from the two proteins showed that a mixture of tryptic hydrolysate of groundnut and peptic hydrolysate of casein gave a high plastein yield (65-70%) as compared with other combinations. The lysine content of these plasteins was 5.6-6.2%. Similar work with sesame tryptic hydrolysate and casein peptichydrolysate gave a lower yield of ethanol precipitable plastein (45-50%) but lysine content was considerably higher (8-10%). Soybean protein which is fairly rich in lysine was also tested with groundnut protein and the yield of plastein was 65-70% with a lysine content of 5.2-5.8%. Work on fortification of groundnut plasteins with N-3-carbobenzyoxylysine methyl ester as a source of lysine yielded 50% ethanol precipitable plastein.

Similar study with sesame protein gave a plastein yield of 15%. These studies included determination of total and TCA precipitable nitrogen and lysine contents of these preparations and comparison with those where in lysine acetylides are used so as to ascertain suitable conditions for lysine fortification. In chemical studies, acetylated and succinylated arachin were fractionated. It was found that one of the minor compounds constituting about 11% of the total protein was acetylated to the extent of 85-90%. Succinylated arachin was easily hydrolysed by  $\alpha$ -chymotrypsin and the rate of hydrolysis increased with the degree of succinylation. Acetylated arachin was soluble in pH range 4.6. Both acetylated and succinylated arachin had greater emulsifying capacity than native arachin.

Report(s) : Final.

Papers Published : -

- 401 Project Title : Studies on newer sources of vegetable proteins.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Protein Technology Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 2,10,720/-.  
 Duration : April 1979-March 1982.  
 Sponsor(s) : CSIR  
 Investigator(s) : Narasinga Rao, M.S. and others.  
 Description : Winged bean flour was compared with soyflour in regard to nitrogen solubility, water and fat absorption, emulsification capacity, foam capacity and foam stability. Winged bean flour was superior in fat absorption and emulsifying capacity but inferior in water absorption and foaming capacity. Nitrogen solubilities versus pH of winged bean was U-shaped, a characteristic of plant proteins. Sodium hexa metaphosphate could shift the solubility minimum to pH 2.1 at 0.03M concentration and NaCl to pH 2.7 at 1 M concentration. Heating decreased solubility in the entire pH range and improved fat and water absorption. Surfactant property depended upon solubilised protein and was decreased by heating. In the case of poppy seed, three varieties (Dhawla Bada, Dhawla Chofa and a commercial variety) were studied. The commercial variety had slightly lower amount of protein and oil. Amino acid composition was almost similar in all varieties and the nitrogen solubility in water was minimum at pH 6.4-6.5 and maximum at pH 9.2. During gel filtration, using Sepharose-6B the total proteins from all the varieties gave 5 bands. Four peaks were obtained on ultracentrifugation with varying  $S_{20,w}$  values, the major fraction being the one with  $S_{20,w}$  values 9.1-10.3. No trypsin of haemagglutinin activity was detected in any of the varieties.

Report(s) : Final.

- Papers Published : 1. Narasinga Rao, M.S. Problems of processing oilseed flours for use as food. Presented at the Symposium on Protein Rich Food in ASEAN, Malayasian Institute of Food Technology, Kaulalumpur, Malaysia, July 1975.  
 2. Narayana, K. Cooking quality characteristics of winged bean (Psophocarpus tetragonolobus). J. Food Sci. Technol. 18(1); 1981; 32  
 3. Narayana, K. and Narasinga Rao, M.S. Functional properties of winged bean (Psophocarpus tetragonolobus) proteins. Presented at the Second Indian Convention of Food Scientists and Technologists, Mysore, February 1981.



4. Srinivas, H. and Narasinga Rao, M.S. Studies on total proteins of poppy seed (P. Somniferum L.). Presented at the Annual Meeting of the Society of Biological Chemists (India) Lucknow, October 1979.

- 402 Project Title : Riboflavin and vitamin B<sub>6</sub> content of oilseeds.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.  
 Project Category : Fund.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : Groundnut (20 varieties), mustard (8 varieties), sesame (6 varieties), safflower (6 varieties) and coconut (9 varieties) were studied by microbiological assay using the method of Association of vitamin chemists, USA. No significant varietal differences in riboflavin content were observed except for coconut varieties. Sesame varieties had the higher average of riboflavin (0.250 mg/100 g) as well as total B<sub>6</sub> (0.79 mg/100 g) while the coconut varieties had the lowest contents of riboflavin (0.039 mg/100 g) and B<sub>6</sub> (0.09 mg/100 g).  
 Report(s) : Annual.  
 Papers Published : 1. Raghunath, M. and Bhavani Belavadi. Riboflavin and total vitamin B<sub>6</sub> content of Indian pulses. J. Plant. Foods. 3; 1979; 205
- 403 Project Title : Proximate analysis vitamin and essential amino acid content of different varieties of oilseeds.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad-500 007.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : Twenty eight high yielding varieties of groundnut (Arachis hypogea) 6 varieties of gingelly (Sesamum indicum), 8 varieties of mustard (Brassica nigra) 6 varieties of safflower (Carthamus tinctorius) and 9 varieties of coconut (Cocos nucifera) were analysed for moisture, protein, fat, ash, tryptophan, methionine, lysine and nicotinamide by AOAC methods. No significant varietal differences in nutrient composition were evident, the coefficient of variation being less than 25% except for ash in groundnut varieties. Groundnut had the highest average protein (29.0%) and nicotinic acid (17.5 mg/100 g) content; gingelly had highest ash (6.8%) and methionine (2.1 g/16 gN) contents; mustard had the highest lysine content (4.8 g/16 gN); and coconut had the highest fat content (68%). Significantly safflower had lower amounts of protein (16.6%), fat (28.9%), ash (1.7%) and nicotinic acid (0.8 mg/100 g) which was considered mainly due to its high seed coat weight (more than 50% of the seed weight). Groundnut had the lowest methionine content (1.0 g/16 gN) and mustard, the lowest tryptophan content (0.5 g/16 gN). Three varieties of groundnut (x-40-x-x-3-D), TMV-10 and X-9-2-13-25-13), one gingelly variety (T.12) and one safflower variety, (APRR-1) were identified to have higher protein and fat contents. Groundnut variety J-11 which was earlier reported to be aflatoxin-resistant had the lowest nicotinic acid content (11.7 ug/100 g). Total solids, protein (N x 6.25) and total sugars in coconut water varied inversely with the volume of the water. Overall results indicated that

the varietal differences in nutrient content of a given oilseed was not marked.

Report(s) : Annual.  
Papers Published : —

### Cotton seed

- 404 Project Title : Cotton seed flour and related studies.  
Organisation : Regional Research Laboratory, Hyderabad 500 009.  
Project Category : Applied.  
Cost : Rs. 38,96,000/-.  
Duration : April 1972-March 1979.  
Sponsor(s) : Laboratory.  
Investigator(s) : Vaidyeswaran, R. and others.  
\*354
- 405 Project Title : Toxicological evaluation of detoxified cotton seed meal.  
Organisation : Hindusthan Lever Limited, Research Centre, Chakala, Andheri (East), Bombay 400 093.  
Project Category : Applied.  
Cost : —  
Duration : October 1977-January 1980.  
Sponsor(s) : Company.  
Investigator(s) : Mulky, M.J. and others.  
\*355
- 406 Project Title : Studies on the elimination of pigment and toxic constituent from cottonseed meal and protein isolate.  
Organisation : Central Food Technological Research Institute, Mysore-570013; Protein Technology Discipline.  
Project Category : Applied.  
Cost : Rs. 1,44,300/-.  
Duration : April 1979-March 1981.  
Sponsor(s) : CSIR  
Investigator(s) : Hanumantha Rao, K. and others.  
Description : Efforts were made to develop a process for the removal of coloured pigment from cottonseed meal and prepare protein concentrates and isolates. Free gossypol from solvent extracted flour could be eliminated completely by alkali extraction but the colour of the isolates was dark. Hydrogen peroxide could remove the colour but it affected the nutritional quality. In studies with cottonseed meal, the colour could be leached out with a dilute mineral acid, and the protein extracted (34% yield) from the meal and washed with acid was nearly white. Addition of tricalcium phosphate improved the colour. Defatted flours from cottonseed (Jayadhar and Varalakshmi varieties) contained 50% protein and 1.6% gossypol. Studies on protein electrophoretic pattern, solubility in acidic and alkaline pH, water absorption, fat absorption, foam capacity and stability, showed that most of the gossypol was associated with high molecular weight protein and varied between the two varieties and could be improved by addition of NaCl in the medium. Higher concentrations of NaCl, however, decreased emulsifying capacity.  
Report(s) : Final.  
Papers Published : 1. Mohan Reddy, I. and others. Isolation and characterisation of 7S protein from cottonseed. Presented at Annual Meeting of Society of Biological Chemists (India), Baroda, November 1981.  
2. Mohan Reddy, I. and others. Isolation and characterisation of 7S protein from glanded cottonseed. (*Gossypium verticillatum*). J. Bio. Sci. 4; 1982; 197.



3. Tinay, A. El and others. Protein and gossipol extractability from cotton seed flour. J. Sci. Food Agric. 31; 1980; 38

407 Project Title : Utilisation of deoiled sal seed cake.  
 Organisation : Regional Research Laboratory, Bhubaneswar 751 013.  
 Project Category : Applied and Exploratory.  
 Cost : Rs. 1,75,000/-.  
 Duration : April 1977-March 1980.  
 Sponsor(s) : Laboratory.  
 Investigator(s) : Rao, K.M. and others.  
 \*361

#### Safflower seed

- 408 Project Title : Chromatographic separation of safflower pigments..  
 Organisation : Marathwada Agricultural University: College of Agricultural Technology, Parbhani- 431 402; Department of Food Science and Technology.  
 Project Category : Fundamental and Applied.  
 Cost : Rs. 5,000/-.  
 Duration : October 1979-February 1982.  
 Sponsor(s) : University and Government of Maharashtra.  
 Investigator(s) : Kadam, P.S. and others.  
 Description : Safflower pigments were extracted by using different solvent systems and two major fractions were identified by using paper chromatography. Overnight soaking organic solvent like methanol was found suitable for extraction.  
 Report(s) : -  
 Papers Published : -
- 409 Project Title : Studies on processing of safflower for production of food grain oilcake.  
 Organisation : Marathwada Agricultural University, Parbhani 431 402; Faculty of Technology; Food Science and Technology Department.  
 Project Category : Applied and Exploratory.  
 Cost : Rs. 20,000/-.  
 Duration : September 1975-August 1979.  
 Sponsor(s) : University.  
 Investigator(s) : Kulkarni, D.N.; Kulkarni, K.  
 \*362
- 410 Project Title : Production and utilisation of safflower proteins.  
 Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani - 431 402; Department of Food Science and Technology.  
 Project Category : Applied.  
 Cost : Rs. 5,000/-.  
 Duration : 1978-1985.  
 Sponsor(s) : University and Government of Maharashtra.  
 Investigator(s) : Kulkarni, D.N.; Ghan, M.M.  
 Description : Earlier, various dehulling procedures for safflower were studied. Whole seeds, kernels and hulls of safflower were also chemically analysed. At present various methods for the fortification of foods with edible safflower flour and the effect of fortification are being studied. Further work involves preparation of protein isolate from safflower edible oilseeds cake by acid centrifugation and to utilise the isolate to fortify bread like products.  
 Report(s) : -  
 Papers Published : -

## Sunflower seed

- 411 Project Title : Sunflower seed and oil.  
 Organisation : Regional Research Laboratory, Hyderabad 500 009.  
 Project Category : Applied.  
 Cost : -  
 Duration : April 1973-March 1981.  
 Sponsor(s) : Laboratory.  
 Investigator(s) : Lakshminarayana, G.; Afzalpurkar, A.B.  
 \*363
- 412 Project Title : Processing of sunflower for edible flour and basic studies on proteins.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Protein Technology Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 1,52,750/-.  
 Duration : April 1977-March 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Shamantaka Sastry, M.C. and others.  
 Description : Dehulling trials indicated that centrifugal sheller was most effective and produced very little kernel breakage. Polyphenols could be removed by pretreatment with 4% NaCl at 5.0 pH overnight and the pretreated meal was free of chlorogenic acid. The resultant flour had 60% protein as against 58% in defatted meal; the available lysine content and in vitro digestibility was 3.4 g/16 g N and 90% respectively as compared to 3.2 g/16 g N and 82% in the case of defatted flour. Dehulling significantly improved nutritional value of sunflower meal protein. Partial removal of crude fibre from defatted commercial expeller cake did not appreciably help in improving nutritional quality of protein. Heat treatment of defatted meal (15 min at 15 pSI) lowered the nutritional value. Lysine fortification (at level of 0.2 g of L-lysine HCl/100 g) was found to correct the limiting amino acid deficiency and PER was comparable to that of casein. NPU studies confirmed the beneficial effects of lysine fortification and adverse effect of heat treatment.  
 Report(s) : Final.  
 Papers Published : 1. Rehma, E.H. and Narasinga Rao, M.S. Characterisation of sunflower proteins. J. Food Sci. 44; 1979; 579.  
 2. Rehma, E.H. and Narasinga Rao, M.S. Effect of denaturants of the oligomeric structure of the 11S protein of sunflower (Helianthus annuus). J. Biosci. 3; 1981; 407  
 3. Rehma, E.H. and Narasinga Rao, M.S. Isolation and characterisation of the major protein fraction of sunflower seeds. J. Sci. Food Agric. 29; 1981; 518  
 4. Rehma, E.H. and Narasinga Rao, M.S. Removal of polyphenols from sunflower meal by various solvents: effects on functional properties. J. Food Sci. 46; 1981; 1521  
 5. Shamantaka Sastry, M.C. Studies on sunflower seed proteins. M.Sc. Thesis, Mysore University, June 1978  
 6. Shamantaka Sastry, M.C. and Narasinga Rao, M.S. Interaction of CGA with 11S proteins of sunflower seed. Presented at Annual Meeting of Society of Biological Chemists (India), Chandigarh, November 1982.



7. Shamantaka Sastry, M.C. and Subramanyam, N. Changes in polyphenols and nutrititional quality of sunflower meal during heat processing. Present at Annual Meeting of Society of Biological Chemists (India), Delhi, October 1978.
8. Shamantaka Sastry, M.C. and Subramanyam, N. Process development studies on sunflower seed to obtain edible protein concentrate. Presented at Ahara-82, AFST International Food Conference, Bangalore, May 1982.
9. Shamantaka Sastry, M.C. and Subramanyan, N. Removal of phenolic constituents from sunflower protein concentrate. Presented at National Symposium on Food Proteins and Feeds, Madras, March 1979.
10. Sripad, G. and others. Extractability of polyphenols of sunflower seed in various solvents. J. Biosci. 4(2); 1982;
11. Subramanyan, N. and Shamantaka Sastry, M.C. Processing of sunflower for edible oil and meal: Some technological considerations. Presented at Seminar on Newer trends in Edible Oils - Processing, Nutrition and Standards, Bombay, March 1978.

\*\*413,414  
\*365

413 Project Title : Effect of dehulling and processing on the physicochemical and nutritional quality of sunflower seed proteins.

Organisation : Central Food Technological Research Institute, Mysore-570013; Protein Technology Discipline.

Project Category : Applied.

Cost : -

Duration : April 1979-March 1980.

Sponsor(s) : Institute.

Investigator(s) : Shamanthaka Sastry, M.C. and others.

Description ;:, A centrifugal sheller with a medium hard rubber lining used at a regulated speed gave an yield of 87-92% of kernels with minimum breakage. The earlier procedure of removal of polyphenols by overnight soaking in 4% sodium chloride at a specific pH level, was modified. It was shown that pretreatment of seeds with very dilute mineral acid solution containing sodium chloride removed 70-75% of polyphenols. A second wash with dilute NaCl solution completely removed polyphenols. The resultant seeds were washed with water to remove NaCl and the defatted flour from the seeds contained 60% protein and had a PER of 2.42 compared to untreated flour (2.20). Fortification with lysine (0.2 g of L-lysine HCl/100 g) corrected the limiting amino acid deficiency and gave a PER comparable to that of casein (2.60). The protein isolate prepared from the NaCl-extracted flour was free from chlorogenic and caffeic acids, white in colour and had 92% protein. Its PER was 1.88 compared with the isolate from untreated kernels (1.74). It was shown that NaCl treatment to flour could yield a protein isolate with a higher available lysine content and was nutritionally superior. Removal of polyphenols considerably reduced water absorption capacity, while fat absorption depended on the method of polyphenol removal. The emulsion capacity and foaming capacity/stability of isolates prepared from polyphenol-free flours were also similar irrespective of the method of polyphenol removal.

Report(s) : -

Papers Published : -

\*\*412,414

- 414 Project Title : Development of methods for dehulling sunflower seed preparation of polyphenol free meal/isolate and its utilisation in foods.
- Organisation : Central Food Technological Research Institute, Mysore-570013;
- Project Category : Applied.
- Cost : Rs. 5,12,900/-.
- Duration : April 1980-March 1983.
- Sponsor(s) : -
- Investigator(s) : Shamantaka Sastry, M.C. and others.
- Description : A new procedure for removal of polyphenols using sodium chloride extraction was developed. The protein concentrate so obtained had minimum polyphenols (0.14%) and was free from chlorogenic acid as compared to the concentrate obtained from other procedures. There was also minimum denaturation.
- Report(s) : -
- Papers Published : 1. Shamantaka Sastry, M.C. and Subramanyan, N. Process development studies on sunflower seeds to obtain edible protein concentrates. Presented at Ahara 82: International Food Conference, Bangalore, May 1982.
2. Sripad, G. and others. Extractability of polyphenols of sunflower seeds in various solvents. J. Biosci. 4(2); 1982; 145

#### Castor seed

- 415 Project Title : Studies on processing of castor seed and effect of processing on the characteristics of protein.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Protein Technology Discipline.
- Project Category : Fundamental and applied.
- Cost : Rs. 50,000/-.
- Duration : April 1978-March 1981.
- Sponsor(s) : Institute.
- Investigator(s) : Narendra Singh; Shashikala Puttaraj.
- Description : Castor bean meal constituents and their interrelationships were studied. Methods for detoxifying the meal were also studied.
- Report(s) : Final
- Papers Published : -
- \*356
- 416 Project Title : Nutritional and biochemical studies on castor seed (Ricinus communis) proteins
- Organisation : Central Food Technological Research Institute, Mysore-570013; Protein Technology Discipline.
- Project Category : Fundamental and applied.
- Cost : Rs. 50,000/-.
- Duration : April 1978-March 1981.
- Sponsor(s) : CSIR
- Investigator(s) : Narendra Singh; Shashikala Puttaraj.
- Description : Conditions for isolation of castor proteins were worked out and the protein characteristics were studied by gel electrophoresis under different buffer systems. The buffer containing B-alanine (pH 4.5) gave the best separation. The gel filtration technique was also standardised. Detoxification studies were also carried out to separate ricin from castor protein by heat treatment and heat-cum-chemical treatment using HCl, NaOH and Ca(OH)<sub>2</sub>. The detoxification was measured by precipitin reaction by immuno-diffusion technique. Among the treatments mere boiling and throwing away the solubles or



autoclaving castor protein isolates were found promising in detoxification. The detoxification was also evaluated by animal studies using mice.

Report(s) : -  
Papers Published : -

### Guar seed

- 417 Project Title : Utilization of guar meal as human food.  
 Organisation : Punjab Agricultural University; College of Home Science, Ludhiana 141 004; Foods and Nutrition Department  
 Project Category : Applied.  
 Cost : Rs. 80,200/-.  
 Duration : February 1978-February 1981.  
 Sponsor(s) : Hindustan Gum and Chemicals Ltd., Bhivani, Haryana,  
 Investigator(s) : Bajaj, S. and others.  
 \*358
- 418 Project Title : Basic and technological studies on guar gum proteins.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Protein Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,56,000/-.  
 Duration : April 1977-March 1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Subramanian, N. and others.  
 Description : Bench scale and large scale studies on preconditioning guar seeds for satisfactory dehusking and desplitting were conducted. Preconditioning was by moisture addition to raw seeds followed by equilibration and sand roasting for optimal periods. A bengal gram roaster was used for sand roasting and a Satake pearling machine modified for small grains was used for dehusking. On milling, the preconditioned grains yielded 35% gum splits on a seed and this had a crude fibre content of 7%. Proximate analysis was conducted on the composition of 5 guar seed varieties as well as on their gum and meal fractions. One of the high molecular weight proteins was isolated in a pure form and its homogeneity established by gel filtration, polyacrylamide gel electrophoresis, ultra centrifugation and DEAE cellulose chromatography. The physico-chemical properties of the protein, which had 6 subunits were studied. Dissociation of the protein was observed in presence of denaturants. Heat coagulation properties of the protein were also studied.  
 Report(s) : Final.  
 Papers Published : 1. Nath, J.P. and Narasinga Rao, M.S. Functional properties of guar seed proteins. J. Food Sci. 46; 1981; 1255  
 2. Nath, J.P. and others. Characterisation of the major proteins of guar seed. Presented at the National Symposium on Food proteins, Loyola college, Madras, March 1979.  
 3. Nath, J.P. and others. Extraction and separation of guar seed proteins. J. Agric. Food Chem. 16; 1978; 1243  
 4. Nath, J.P. and others. Isolation and characterisation of the major fraction of guar proteins. J. Agric. Food Chem. 28; 1980; 844
- 419 Project Title : Studies on guar protein and toxic constituents of guar seed.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Protein Technology Discipline.

Project Category : Fundamental and applied.  
 Cost : Rs. 6,00,000/-.  
 Duration : April 1980-March 1983.  
 Sponsor(s) : CSIR  
 Investigator(s) : Ramamani, S. and others.  
 Description : Functional properties of detoxified guar meal were compared with those of defatted soy meal. Detoxification of guar meal was carried out by autoclaving, extraction with aqueous methanol and isopropanol or dilute hydrochloric acid. Acid extracted guar meal gave lower nitrogen solubility (NS) at all pH values as compared to alcohol-extracted meals. 1M NaCl improved NS values of alcohol-extracted meals at pH 7. Though water absorption capacity increased in detoxified meal, it had no correlation with protein. The pH-EC profile of guar meals was similar to pH-NS profile. Fat absorption capacity decreased on detoxification and was inversely correlated with bulk density. Defatted guar meal had, however, the highest emulsifying capacity (EC) at the pH of minimum NS. In the defatted samples, autoclaving did not affect EC as compared to others. EC pattern of guar meals and soy meal showed some difference with the addition of NaCl. The foam capacity and foam stability were highest in 80% iso-propanol-extracted samples. In raw guar meal, saponin content was much higher (4.3 mg/g) as compared with that of autoclaved meal (1.7 mg/g). Defatted meal gave the value of 90.8 mg/g while the acid extracted meals was practically saponin-free.

Report(s) : -  
 Papers Published : 1. Razia Tasneem and others. Functional properties of guar seed (*Cyamopsis tetragonabba*) meal detoxified by different methods. Presented at National Symposium on proteins, Madras, 1982.

#### Mustard seed

420 Project Title : Intrinsic toxic materials in mustard and cotton seed.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Protein Technology Discipline.  
 Project Category : Fundamental.  
 Cost : Rs. 1,17,800/-.  
 Duration : April 1977-March 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Narasinga Rao, M.S. and others.  
 Description : The interaction of toxic constituents of bovine serum albumin (BSA) under various experimental conditions of pH, salt concentration, dielectric constant, etc. was studied. The experimental techniques used were equilibrium dialysis, fluorescence quenching, UV spectroscopy and ultracentrifuge techniques.

Report(s) : Final.  
 Papers Published : 1. Appu Rao, A.G. Study of bovine serum albumin - gossypol reaction by circular dichroism. Presented at Annual Meeting of Society of Biological Chemists (India), Chandigarh, November 1982.  
 2. Kishore Kumar Murthy, N.V. and Narasinga Rao, M.S. Binding allylthiocyanate by bovine serum albumin. Presented at Annual Meeting of Society of Biological Chemists (India) New Delhi, October 1978.  
 3. Kishore Kumar Murthy, N.V. and Narasinga Rao, M.S. Interaction of allylisothiocyanate with bovine serum albumin. J. Biosci. 1(2); 1979; 125



- 421 Project Title : Changes in flavour and functional properties of mustard and rape seed.
- Organisation : Central Food Technological Research Institute, Mysore - 570013; Protein Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 92,680/-.
- Duration : April 1977-March 1979.
- Sponsor(s) : Institute.
- Investigator(s) : Kantaraj Urs, M. and others.
- Description : Polyphenolic compounds were found to play a minor role in flavour profiles of concentrates. Flavour principles could be removed by extraction with polar solvents like isopropanol and aqueous ethanol as well as by enzymic modification of proteins. Polar solvent lowered in vitro digestibility. Improved solubility of heat denatured proteins and increased fat absorption capacity were obtained by controlled hydrolysis using papain; emulsifying capacity was, however, adversely affected. In studies on effect of denaturation in high molecular 12S fraction of mustard protein, it was found that sodium dodecyl sulphate (SDS) caused aggregation and dissociation at low concentration (0.1%) and only dissociation at higher concentrations; dissociation was time dependent. The chlorogenic acid in the meal was associated with low molecular weight 1.3S fraction. Solubility as a function of pH was similar in mustard and rape seed proteins. A method was developed to separate the high and low molecular weight protein fractions.
- Report(s) : Final.
- Papers Published : 1. Gururaja Rao, A. and Narasinga Rao, M.S. Comparative studies of on the proteins of mustard (Br. juncea) and rape seed (Br. campestris). Presented at the Symposium on protein Foods, Madras, March 1979.
2. Gururaja Rao, A. and Narasinga Rao, M.S. Comparative study of high molecular weight protein fraction of mustard (B. juncea) and rape seed (B. campestris). Int. J. Peptide Res. 18; 1981; 154
3. Gururaja Rao, A. and Narasinga Rao, M.S. Effect of SDC on the major fraction of mustard protein. Presented at the International Symposium on Rape seed, Melmo, Sweden, July 1978.
4. Gururaja Rao, A. and Narasinga Rao, M.S. Effect of sodium dodecyl sulphate on the 12S fraction of mustard (Br. juncea). Int. J. Peptide Res. 14; 1979; 300
5. Gururaja Rao, A. and others. Studies on proteins of mustard seeds (Br. juncea). Canadian Inst. Food Sci. Technol. J. 11; 1978; 155
6. Kowsalya S. Murthy and Kantharaj Urs, M. Scope for better utilisation of rapeseed in India. Presented at International Symposium on Rapeseed, Melmo, Sweden, July 1978.
7. Kowsalya S. Murthy and others. Effect of mustard protein concentrate on zinc copper and cholesterol levels of serum and liver of albino rats. Presented at National Symposium of Protein Foods and Feeds, Madras, April 1982.
8. Kowsalya, S. Murthy and others. Nutritional quality of low phytic acid mustard protein concentrate. Presented at the Second Indian Convention of Food Scientists and Technologists, CFTRI, Mysore, February 1981.
9. Krishna Murthy, K.S. and others. Functional properties of mustard and rape seed protein concentrates. Presented at Symposium on Protein Foods, Madras, March 1979.

422 Project Title : Research programme on rapeseed/mustard protein utilisation.  
 Organisation : Central Food Technological Research Institute, Mysore-570013;  
 Protein Technology Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 15,60,000/-.  
 Duration : April 1979-March 1984.  
 Sponsor(s) : CSIR  
 Investigator(s) : Kantharaj Urs, M. and others.  
 Description : Improvements were made in the processing of mustard seed particularly in regard to detoxification to eliminate anti-nutritional factors. The mustard protein concentrate (MPC) prepared based on improved processing was evaluated for nutritional quality by PER and RNU. NPC was also studied for interaction of allyl isothiocyanate (goitrogenic agent) with bovine serum albumin. Two types of interaction were indicated, a weaker one possibly involving tryptophan residues and a chemical reaction between E-HN<sub>2</sub> and allylisothiocyanate. A similarity was also noticed in the physico-chemical properties of mustard and rape seed proteins but with a few significant differences like those in myosinases, and susceptibility of high molecular weight proteins to proteolytic enzymes as well as to denaturation. Experiments were also conducted in incorporating MPC in high protein biscuits and weaning food formulations based on cereals and pulses. The products had good water absorption capacity and a well rated nutritional quality.

Report(s) : -  
 Papers Published :  
 \*\*421

#### Coconut

423 Project Title : Technology of coconut and related palms.  
 Organisation : Regional Research Laboratory, Trivandrum - 13.  
 Project Category : Applied.  
 Cost : Rs. 7,50,000/-.  
 Duration : 1979-1983.  
 Sponsor(s) : CSIR  
 Investigator(s) : Satyavati Kutty, K. and others.  
 Description : A technique for efficient mechanical drying of coconut is developed and the development of roasted flavour in coconut oil is studied. The preservation of tender coconut and coconut water is envisaged and a small scale solvent extraction plant for oil cake is developed. An edible grade protein from coconut cake is isolated and the technology of oil is studied.

Report(s) : -  
 Papers Published : 1. Satyavati Kutty, K. Oil milling industry in Kerala. Indian Coconut Journal. 10(6); 1979;  
 2. Satyavati Kutty, K. and others. Home preservation of split coconuts. Indian Coconut J. 10(5); 1979;  
 3. Sreemula Nathan, H. and others. Control of spoilage during sundrying. Food Sci. and Tech. 16(5); 1979.  
 4. Jayalakshmy, A. and others. Studies on the development of roasted flavour in coconut oil. (In press)

424 Project Title : Processing and quality aspects of coconut.  
 Organisation : CSIR Trivandrum Complex, Industrial Estate, P.O., Papanamcode, Trivandrum 695 019.  
 Project Category : Applied.



Cost : -  
 Duration : 1976-1979.  
 Sponsor(s) : Council of Scientific and Industrial Research, New Delhi.  
 Investigator(s) : Sreemulanathan, H. and others.  
 \*366

## Groundnut

- 425 Project Title : Study on the nutritional, storage practices and consumption of groundnuts and groundnut preparations in the dry land regions of Andhra Pradesh.  
 Organisation : Andhra Pradesh Agricultural University, College of Home Science, Hyderabad 500 004.  
 Project Category : Applied and survey.  
 Cost : Rs. 3,000 per annum.  
 Duration : April 1981-continuing.  
 Sponsor(s) : Food foundation.  
 Investigator(s) : Geervani, P.; Anurag Chaturvedi.  
 Description : The consumption patterns of groundnuts among farm families will be assessed by interview and based on the data, the most common forms will be processed in the laboratory and analysed for its chemical composition and biological quality by standard techniques.  
 Report(s) : -  
 Papers Published : -
- 426 Project Title : Enzymatic modification of protein rich materials to improve product characteristics.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Protein Technology Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 1,30,600/-.  
 Duration : April 1977-March 1979  
 Sponsor(s) : CSIR  
 Investigator(s) : Srinivasan, K.S. and others.  
 Description : Groundnut flour was treated with proteolytic enzymes with protease, molisin, papain, and several others to obtain a product organoleptically acceptable. The desired functionally optimum conditions for the enzyme treatment were standardised. The product obtained was free from nutty odour and showed better functional properties as well as product performance.  
 Report(s) : Final.  
 Papers Published : 1. Srinivasan, K.S. and others. Studies on bland groundnut flour. J. Food Sci. Technol. 16; 1979; 192,  
 \*169
- 427 Project Title : Studies on the functional properties of enzyme treated groundnut flour and its utilisation in food product development.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Protein Technology Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 2,37,740/-.  
 Duration : April 1979-March 1981.  
 Sponsor(s) : CSIR  
 Investigator(s) : Srinivasan, K.S. and others.  
 Description : Enzyme modified groundnut flours were prepared using prozyme, protease and papain. These flours were found to possess better functional properties and the enzyme had removed the flavour.

Some products like high protein biscuits and chewy candies prepared by incorporating the enzyme treated flours had improved nutritional and organoleptic properties.

Report(s)

Final.

Papers Published

1. Bhagya, S. and Srinivasan, K.S. Effect of different methods of drying on the functional properties of enzyme treated groundnut flour. Presented at Ahara 82, AFST International Food Conference, Bangalore, May 1982.
2. Madhavi, D.L. and Srinivasan, K.S. Effect of heat processing on the functional properties of groundnut flour. Presented at National Symposium on protein Foods and Feeds, Madras, April 1982.
3. Srinivasan, K.S. and others. Studies on bland groundnut flour. J. Food Sci. Technol. 16; 1979; 192.

\*428

428 Project Title : Large scale trials for the manufacture of enzyme treated groundnut flour.

Organisation : Central Food Technological Research Institute, Mysore-570013; Process Design and Development Discipline.

Project Category : Applied.

Cost : Rs. 75,000/-.

Duration : October 1980-December 1981.

Sponsor(s) : Institute.

Investigator(s) : Krishnaiah, M.M. and others.

Description : Equipment for streamlining the process were assembled and trials were carried out. Process conditions both from kernel and edible groundnut flour have been standardised. Optimum conditions for substrate concentration, enzyme quantity and other drying parameters have been standardised. Feasibility report for a commercial viable unit is prepared and product acceptance studies are conducted.

Report(s) : -

Papers Published : -

\*\*427

429 Project Title : Calcium derivative of groundnut protein: properties and uses in breakfast flakes and snack formulations.

Organisation : Central Food Technological Research Institute, Mysore-570013 Protein Technology Discipline.

Project Category : Applied.

Cost : Rs. 1,20,000/-.

Duration : April 1979-March 1981.

Sponsor(s) : CSIR

Investigator(s) : Ramanatham, G. and others.

Description : A formula was evolved to prepare breakfast flakes based on groundnut seeds, greengram flour, wheat flour and additives like sugar, salt and calcium. The process involves (a) dough preparation, (b) autoclaving (c) disintegration of heated dough into small pieces of different particle sizes, (d) tempering (e) flaking and (f) blistering and toasting. The product had a crunchy texture and a satisfactory absorption and flake retention capacity when dehydrated with water or milk. It had about 16% protein and furnished about 360 cal/100 g. A similar process was also evolved to obtain a product similar to Upmav which dehydrated well and could find application in applied nutrition progress.

Report(s) : Final.



- Papers Published : 1. Ramanatham, G. and others. Calcium derivatives of groundnut protein: Properties and uses in certain food formulations. Presented at Ahara 1982: AFST International Food Conference, May 1982.
- 430 Project Title : Development of products based on groundnut protein - large scale trials.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Protein Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 7,59,000/-.
- Duration : April 1981-March 1984.
- Sponsor(s) : Institute.
- Investigator(s) : Srinivasan, K.S. and others.
- Description : Large scale preparations of high protein biscuits by incorporating modified groundnut flour (at different levels) in collaboration with a local biscuit factory have been carried out. Consumer acceptability trials indicated that the flour could be incorporated at 20% level. Large scale trials at Miltone plant (Bangalore Dairy) indicated that the flavour profile of miltone (vegetable protein toned milk) could be improved by using azeotropic extracted groundnut flour. Modifications have been made in the process of preparation of coffee whitener. These are 1) a two stage extraction procedure has been adopted for the recovery of the protein from groundnut flour and 2) the concentration step has been eliminated. Groundnut flour treated with microorganism had higher water and fat absorption capacity than the untreated flour.
- Report(s) : Interim report.
- Papers Published : -
- 431 Project Title : Burshane or Biogas fired easy to operate roaster for roasting of groundnuts or other oil bearing seeds, corn, rice, etc.
- Organisation : Bhabha Atomic Research Centre, Bombay-470 085.
- Project Category : Applied (Unit designed and fabricated at FIPLY)
- Cost : Rs. 2 to 5 thousand approx.
- Duration : Working for last 8 years without any problem.
- Sponsor(s) : Centre.
- Investigator(s) : Bongirwar, D.R.
- Description : -
- Report(s) : -
- Papers Published : Bongirwar, D.R. and others. Studies on defatting of peanuts and soyabeans for developing ready to eat snack items, Indian Food Packer. 31(3); 1977; 61
- 432 Project Title : Studies on defatting of peanuts and soyabeans for developing ready to eat snack items.
- Organisation : Bhabha Atomic Research Centre, Bombay 470 085.
- Project Category : Applied (For completing above studies a roaster, skin removal machine of peanuts and explosive puffing gun were designed and fabricated in FIPLY).
- Cost : -
- Duration : -
- Sponsor(s) : Centre.
- Investigator(s) : Bongirwar, D.R. and others.
- Description : -
- Report(s) : -

## Papers Published

1. Bongirwar, D.R. and others. Studies on defatting of peanuts and soyabeans for developing ready to eat snack items. Indian Food Packer. 31(3); 1977; 61
2. Bongirwar, D.R. and others. Use of dehydration methods for development of convenience foods. Proc. of a AFST seminar on convenience foods: Opportunities and challenges, Bombay 1980, p.6-9

## Cashew

- 433 Project Title : Research project for studies on pests of stored cashew and their control.
- Organisation : Kerala Agricultural University; College of Agriculture, Vellayani 695 522; Entomology Department.
- Project Category : Applied.
- Cost : Rs. 27,208/-.
- Duration : February 1978-January 1980.
- Sponsor(s) : Cashew Export Promotion Council, Cochin, Kerala.
- Investigator(s) : Mohan Das, N.; Oommen, C.N.

\*371

## Fruits and Vegetables

- 434 Project Title : Gas storage of fresh fruits and vegetables at ambient temperatures.
- Organisation : Central Food Technological Research Institute, Mysore-570013;
- Project Category : Applied.
- Cost : Rs. 5,49,000/-.
- Duration : April 1981-March 1983.
- Sponsor(s) : Institute.
- Investigator(s) : Patwardhan, M.V. and others.
- Description : Experiments were conducted with Robusta banana bunches (packed in polythene pouches), fully mature Alphonso mangoes (water sinkers) and carrots to evaluate their quality and storage life after smoke treatment ( $\text{CO}_2 + \text{O}_2$ ). In general, there was considerable improvement in storage life of these commodities though for different periods. However, there were some chemical and metabolic changes observed. There was better utilisation of  $^{14}\text{C}$  aspartate and poor utilisation of  $^{14}\text{C}$  succinate and  $^{14}\text{C}$  acetate in bananas. The metabolism of  $^{14}\text{C}$  succinate,  $^{14}\text{C}$  acetate and  $^{14}\text{C}$  malate was affected in mangoes kept for 7 days under the modified atmosphere but picked up on subsequent ripening. Individual wrapping of mangoes after fungicidal treatment gave better results.
- Report(s) : -
- Papers published : -

- 435 Project Title : Extension of the post harvest storage life of some important fruits and vegetables during storage at ambient and low temperature conditions.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Fruit and Vegetable Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 8,88,700/-.
- Duration : June 1982-May 1985.
- Sponsor(s) : Institute.
- Investigator(s) : Narasimham, P. and others.
- Description : Studies were carried out with potatoes and with Royal delicious apples. The dry treatment of potatoes reduced significantly the number of sprouted tubers and the sprout weight and the end of the storage. Storage experiments carried out



apples individually with cling film (developed and marketed by ICI, India) revealed that the physiological loss in weight due to transpiration and the resultant shrivelling could be checked. Several experiments were carried out to study the antimicrobial effects of naturally occurring terpenes (principal ingredients of essential oils). Camphor, a diterpene had inhibited the growth rate of fungal pathogen but did not effect the respiratory O<sub>2</sub> uptake by the test organism. Camphor adversely affected the cell division/mitosis) of the onion root tips used as a model system.

Report(s) : -  
Papers Published : -

436 Project Title : Cell structure, biochemistry of fruit ripening and low temperature storage.  
Organisation : Central Food Technological Research Institute, Mysore-570013; Fruit and Vegetable Technology Discipline.  
Project Category : Fundamental and applied.  
Cost : Rs. 97,300/-.  
Duration : April 1979-March 1981.  
Sponsor(s) : Institute.  
Investigator(s) : Patwardhan, M.V. and others.  
Description : The optimum storage period for keeping Alphonso mangoes of the early harvest at 55 ± 1 F, RH 85-90% has been found to be 22 to 23 days which took 5 to 6 days at RT (73-86 F, RH 65%) for ripening. These low temperature stored fruits had a total storage life of 27.29 days compared to RT stored fruits which had 16 days. A period of 3 to 4 days delay in keeping late harvest mangoes at 55 F or 68 F after harvest resulted in a decrease in total storage life of 19 days and 15 days respectively compared to 9 days storage life at RT. Hot water treatment to these 55 F stored fruits reduced the spoilage during further ripening at RT and also showed better firmness, absence of defects and better overall quality of the whole fruits. Hypobaric storage reduced the rate of ripening in both green tomatoes and bell pepper. Tomatoes and bell pepper had 6 and 2-3 days more storage life respectively than RT stored fruits. Polyphenoloxidase (PPO) from ripe mango peel has been purified to about 100 fold by ion-exchange chromatography followed by gel filtration and some of its properties were studied. The enzyme had a molecular weight of 1,36,000. Its pH optimum was 5.4 temperature optimum 50 C and KM for catechol was 3.49 mM. It possessed only catecholase activity and was specific to O-dihydroxyphenols.

Report(s) : -  
Papers Published : -

437 Project Title : Studies on post-harvest transpirational losses in potatoes, apples and oranges during storage at ambient temperature and humidity conditions.  
Organisation : Central Food Technological Research Institute, Mysore-570013; Fruit and Vegetable Technology Discipline.  
Project Category : Applied.  
Cost : Rs. 91,000/-.  
Duration : April 1980-March 1982.  
Sponsor(s) : Institute.  
Investigator(s) : Narasimham, P. and others.  
Description : Vegetable oils, vegetable hydrocarbon waxes and natural synthetic gums like gum arabic, polyvinyl alcohol, gelatin and

polyethylene glycol (in solution and emulsion forms) were tested for controlling water vapour transmission rate of coated papers and their air permeability behaviour. Polyvinylalcohol, gelatin and polyethylene glycol ethylene showed promise. The relative proportion of vegetable waxes (sugarcane wax) to hydrocarbon waxes (paraffin and microcrystalline) appeared to play a significant role in curtailing water vapour transmission rate without adversely affecting the air permeability rate.

Report(s) : -  
Papers Published : -

438 Project Title : Cold preservation of fruits and vegetables of North India including hilly regions.  
Organisation : University of Roorkee, Roorkee. Uttar Pradesh 247 672; Department of Mechanical and Industrial Engineering.  
Project Category : Applied.  
Cost : Rs. 3,00,000/-.  
Duration : 1980-1985.  
Sponsor(s) : University Grants Commission.  
Investigator : Varma, H.K. and others.  
Description : The thermophysical properties of fruits and vegetables at cold storage temperature are being determined and their behaviour investigated. Preliminary investigations are being carried out on apples and potatoes.

Report(s) : -  
Papers Published : -

439 Project Title : Isolation, characterisation and commercial utilisation of natural innocuous corrosion inhibitors for preventing excessive corrosion in canned food products.  
Organisation : Central Food Technological Research Institute, Mysore-57013; Fruit and Vegetable Technology Discipline.  
Project Category : Applied.  
Cost : Rs. 86,840/-.  
Duration : April 1977-March 1979.  
Sponsor(s) : CSIR  
Investigator(s) : Eipeson, W.E.; Singh, N.S.  
Description : Conditions for isolation and utilisation of tin plate corrosion inhibitors from crude soybean lecithin were simplified. As the inhibitors were chemically identified as constituent of most plant and animal tissues, the possibility of their being toxic was ruled out. All the constituents of the inhibitor preparation had almost the same extent of inhibitory nature. Trials were conducted successfully with some products like bitter ground, ivy gourd and papaya in sugar syrup. The inhibitor, however, was not effective in products like tomato paste having very high consistency.

Report(s) : Final.  
Papers Published : 1. Eipeson, W.E. and Sastry, L.V.L. Corrosion of tin plate cans by vegetables - Corrosion by ivy gourd with special reference to corrosion accelerating and inhibiting compounds. J. Food Sci. Technol. 15; 1978; 113.



- 440 Project Title : Development of steeping solution for preservation of fruits and vegetables for domestic consumption.
- Organisation : Central Food Technological Research Institute, Mysore-570 013; Microbiology and Fermentation Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 1,83,800/-.
- Duration : July 1979-May 1981.
- Sponsor(s) : Institute.
- Investigator(s) : Subbarao, M.S. and others.
- Description : Of the terpenic and non-terpenic fraction of the orange oil the former exhibited antifungal activity against Rhizopus, Fusarium and Aspergillus at 6-10 mg% levels. At 6 mg% level, the fraction showed nearly 95% inhibition of Aspergillus and fusarium. Limonene oxide and terpene formate did not inhibit any of the test moulds. With non-terpenic fraction, nearly 200 mg% concentration was needed for complete inhibition of test moulds; terpene acetate at this level completely inhibited Rhizopus and Fusarium but showed only 90% inhibition against Aspergillus. Pyrocatachol even at 2 mg level per plate preferentially inhibited Rhizopus but showed limited growth of Aspergillus. At 3 mg level per plate, all test moulds were inhibited. Others showing antifungal activity were alcoholic extraction of peels of Neelam and Totapuri mangoes, turmeric powder (which at 0.5% level inhibited Rhizopus but not Aspergillus), garlic extract at 3% level, phenolic extracts of deoiled sandal and teak (at 80 mg% level) and extract of Alpenia galanga (at 1% level). Mixture of extracts of garlic, talispatre (Raxes baccata), A. galanga, Kosta (Sausseria lappa), Ajawan (Carum ajawanica) and guggal (Balsandrum mukul.) preferentially inhibited Escherichia coli, Streptococcus aureus and S. fecalis at 2% level as also ethyl acetate fraction of phenolics (20 mg% level) from teak and deoiled sandal. Sprays of alcoholic extracts of the above spice mixtures at 2.5% and ethyl acetate fraction of teak and sandal at 20 mg% level inhibited natural mould growth of french bean, lady's finger and brinjal for 8-10 days in perforated plastic pouches.
- Report(s) : Consolidated report.
- Papers Published : -
- 441 Project Title : Study on freezing preservation of fruits and vegetables.
- Organisation : Government Fruit Preservation and Canning Institute, 18-B Ashok Marg, Lucknow.
- Project Category : Applied.
- Cost : -
- Duration : 1979-1983.
- Sponsor(s) : Government of Uttar Pradesh.
- Investigator(s) : Kapur, K.L. and others.
- Description : Steps for freezing preservation of various fruits and vegetables are being standardised to suit local conditions. Feasibility of freezing preservation of fruit juices has already been studied. Studies are underway to record data regarding the acceptability of precooked frozen vegetables.
- Report(s) : -
- Papers Published : -
- 442 Project Title : Process development.
- Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.
- Project Category : Applied.

- Cost : 1975-1983.  
 Duration : Government of Uttar Pradesh.  
 Sponsor(s) : Kapur, K.L. and others.  
 Investigator(s) : The project aims to study the existing problems regarding processing of fruits and vegetables and suggest modifications. Processes for canning water chestnut and bottling of peas were standardised. A process for canning of okra is now under study.  
 Description :  
 Report(s) :  
 Papers Published : 1. Kapur, K.L. and others. Studies on processing of water chestnut (*Trapa bispinosa* Roxb.) Indian Food Packer. 34(1); 1980; 27-8
- 443 Project Title : Prevention of growth of microorganisms on fruits by the use of antimicrobial agents of plant origin.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Microbiology and Fermentation Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 98,400/-.  
 Duration : June 1982-June 1983.  
 Sponsor(s) : Institute.  
 Investigator(s) : Subba Rao, M.S. and others.  
 Description : Antimicrobial plant extract formulations were tried with limes, oranges and musambi fruits. The treated fruits were kept at ambient conditions of temperature. Results of studies have indicated that lime, oranges and musambi can be kept in an acceptable condition for a period of 20 to 25 days respectively. Dehydrated, shrivelling, discolouration and some microbial spoilage was noticed with untreated fruits. It was also observed that an hour dip in emulsion was necessary for musambi fruits as a pretreatment before the usual coating of fruits. The loss of moisture is also less in treated fruits than the control. Bananas treated with the antimicrobial formulation showed a shelf-life extension only for 48 hours. Mangoes treated with the above formulation showed no signs of improvement in the keeping quality. As only few experiments have been carried out with mangoes the results are not conclusive.  
 Report(s) : -  
 Papers Published : -
- 444 Project Title : Correlation of physico-chemical test on indigenous electrolytic tin plate to the shelf-life of some processed foods canned in it.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Packaging Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,31,000/-.  
 Duration : April 1977-March 1979.  
 Sponsor(s) : CSIR  
 Investigator(s) : Mahadevaiah, M.; Gowramma, R.V.  
 Description : Canning and storage studies of several fruit and vegetable products were conducted with 6 samples in each of the four batches of cans fabricated with Rourkela electrolytic tin plate. No significant differences were found in corrosion behaviour of different batches of tin plate. However, imported cans with lacquer based on polyester were found more suitable than indigenous lacquered cans for packing products like mango juice.



Report(s) : Final.

Papers Published : 1. Mahadevaiah, M. Correlation of physico-chemical characteristics of tin plate with the shelf life of the fruit products canned in indigenous electrolytic tin plate. (Presented at Technical Committee Meeting of All India Food Preservers Association, Bangalore, June 1979).

2. Mahadeviah, M. Quality control of tin plate containers used for processing canned food products. Presented at First Indian Convention of Food Scientists and Technologists, Mysore, June 1978.

3. Mahadevaiah, M. Suitability of differential tin plate for canning fruits and vegetables. Presented at Annual Session of All India Food Preservers Association, May 1978.

4. Mahadeviah, M. and Gowramma, R.V. Suitability of lacquered cans for canning mango juice. J. Food Sci. Technol. 16(3); 1979; 114.

5. Mahadevaiah, M. and others. Assessment of Rourkela tin plate for canning fruit and vegetable products. Indian Food Packer. 31(2); 1977; 5.

6. Mahadeviah, M. and others. Correlation of physico-chemical characteristics of indigenous electrolytic tin plate with the shelf life of fruits and vegetables canned in it. Indian Food Packer. 34(4); 1980; 25.

7. Mahadevaiah, M. and others. Influence of tinplate variables on the corrosion of tin plate containers with mango and orange products. J. Food Sci. Technol. 13; 1976; 18

8. Mahadevaiah, M. and others. Suitability of tin free steel for canning processed food products. Presented at Ahara 82: International Food Conference, Bangalore, May 1982.

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445 Project Title : Biochemical changes in fruits and vegetables during ripening and storage at low temperature.

Organisation : Central Food Technological Research Institute, Mysore-570013; Fruit and Vegetable Technology Discipline.

Project Category : Applied and fundamental.

Cost : Rs. 1,26,500/-.

Duration : January 1975-March 1979.

Sponsor(s) : CSIR

Investigator(s) : Patwardhan, M.V. and others.

Description : In studies on the effect of thiobendazole, a systematic fungicide, on the activities of mitochondrial and cytoplasmic enzymes in germinated plant material, it was found that the compound inhibited only the mitochondrial respiratory-linked enzymes. The mitochondrial succinate dehydrogenase was inhibited both chill sensitive and chill resistant tissues. In metabolic studies of organic acids in ripening fruit by vacuum infiltration of U <sup>14</sup>C-aspartic acid, it was found that the turnover rate of organic acid is very high in mangoes and apples as compared to oranges and bananas. Phosphoenol pyruvate carboxykinase activity was detected in raw climacteric mangoes which increased with ripening. The enzyme was purified and its properties studied. Arginine metabolism and the changes in fatty acid composition of total lipids in mango pulp during ripening and low temperature storage were also studied. Other factors studied as part of the project included conversion of injected labelled glucose in banana into organic acids and ribosomal isolation and labelled amino acid incorporation activity in plant tissues exposed to low temperature.

Report(s) : Final.

Papers Published : -

\*429

446 Project Title : Studies on freezing of peas, mango slices and mango pulp.  
 Organisation : Central Food Technological Research Institute, Mysore-570013;  
 Fruit and Vegetable Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 71,400/-.  
 Duration : April 1978-March 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Patwardhan, M.V. and others.  
 Description : Suitability of three varieties (Early Badgers, Delhi and Hill) of peas, mango slices and mango pulp have been evaluated for freezing quality. In peas, there were varietal differences and floaters were unsuitable while others were suitable. In mango slices and pulp proper treatment with chemicals like CaCl<sub>2</sub>, SO<sub>2</sub> and suitable packaging gave good product.  
 Report(s) : Final.  
 Papers Published : -

447 Project Title : Utilisation of solar energy for dehydration of fruits and vegetables.  
 Organisation : Regional Research Laboratory, Canal Road, Jammu Tawi-180001.  
 Project Category : Applied.  
 Cost : Rs. 62,500/-.  
 Duration : July 1976-December 1984.  
 Sponsor(s) : Council of Scientific and Industrial Research.  
 Investigator(s) : Bhatia, A.K. and others.  
 \*375.

448 Project Title : Screening of different fruit and vegetable varieties for processing.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow 226 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1972-  
 Sponsor(s) : Government of Uttar Pradesh, Horticulture and Fruit Utilisation Directorate, Lucknow.  
 Investigator(s) : Kapur, K.L. and others.  
 \*374

449 Project Title : Technological Assessment of new varieties of fruits and vegetables developed by PAU/HAU/HPAU for their quality characteristics and their suitability for processing in different forms.  
 Organisation : Central Food Technological Research Institute, Experiment Station, Ludhiana 141 008, India.  
 Project Category : Applied.  
 Cost : Rs. 92,500/-.  
 Duration : May 1981-May 1984.  
 Sponsor(s) : Institute.  
 Investigator(s) : Kalra, C.L. and others.  
 Description : Four varieties of green peas viz. P-88, P-87, Sel-3487 and Bonneville were analysed for physico-chemical characteristics and dehydrated in a cross-flow dehydrator at 65/55 C. Moisture in the varieties ranged from 73.1-79.2%, total sugars 3.22 to 4.97 and alcohol insoluble solids 15.1 to 18.3% (FWB). The drying ratio ranged from 4.3:1 for P-88 to 5.0:1 for Bonneville. The rehydration ratios varied from 1:2.9 (Bonneville)



to 1:3.2 with minor reduction during storage over 6 months. The variety P-87 and P-88 were adjudged the best for dehydration. Three varieties of brinjals namely S-16, Punjab Bahar and green oblong were assessed for their physical characteristics and dehydrated in cross-flow dehydrator to determine their suitability for Bhatha preparation. In package fumigation studies were conducted on mushroom of variety Agaricus bisporus for maintaining its whiteness and freshness. Preliminary results revealed that KMS and citric acid at 1% level though retained the freshness of the mushrooms, packed in 100 gauge polyethylene bags to some extent, it led to yellowish discolouration and sliminess on the mushrooms. In low concentrations no significant difference was noticed in the control and treated mushrooms.

Report(s) : -  
Papers Published : -

450 Project Title : Storage of fresh fruits and vegetables in pyramid like structures to extend their shelf life at room temperature.  
Organisation : Central Food Technological Research Institute, Mysore-570013; Fruits and Vegetable Technology Discipline.  
Project Category : Applied.  
Cost : Rs. 90,180/-.  
Duration : April 1979-March 1981.  
Sponsor(s) : Institute.  
Investigator(s) : Eipeson, W.E. and others.  
Description : Plywood pyramids of about 0.1 m<sup>3</sup> volume were used for the studies. For comparison square plywood boxes and thermocole pyramids were used. They were provided with windows for handling the test products and with rubber diaphragms for withdrawal of gas for analysis. The vegetables tried (tomato, carrot, beet-root, knol-khol, capsicum, lemon) showed 3-6 times more of storage life inside the pyramid as compared to those kept outside. Chopping the ends of carrot further increased storage life; carrots, for that matter, stored better in the pyramid than in cold storage. Square box gave only half of the shelf life. Plywood and thermocole structures were almost similar. Humidity and CO<sub>2</sub> inside the pyramid were higher than outside and there was no temperature difference. Storage studies conducted in large pyramids (0.4 m<sup>3</sup>) with 25 kg lots indicated that, unlike in smaller pyramids (0.1 m<sup>3</sup>), the RH of the commodities increased from 85% to 90% in one day resulting in rapid microbial spoilage. The spoilage reduced with reduced quantities of commodities (8 kg). The pyramids gave lower respiration rates and better texture of commodities.

Report(s) : -  
Papers Published : -

451 Project Title : Studies on dehydration of fruit and vegetables using solar energy and mechanical drying of fruits without preservatives  
Organisation : Central Food Technological Research Institute Mysore, 570013; Fruit and Vegetable Technology Discipline.  
Project Category : Applied.  
Cost : Rs. 1,50,000/-.  
Duration : April 1979-March 1981.  
Sponsor(s) : Institute.  
Investigator(s) : Patwardhan, M.V. and others.  
Description : Experiments with a polythene tent dryer were conducted on a variety of fruits and vegetables. The solar dryer was

faster as compared to sun-drying. Vegetables like okra lost their green colour due to photodegradation and replacement of polythene with PVC resulted only in slightly better colour retention, while the overall rate of drying was faster in solar drying. Rate of drying during the first two hours was faster in the case of sundrying. In studies with some fruits like sapota, guava, papaya and jackfruit, dehydration with or without lye peeling and reconstitution by boiling the dehydrated product with light syrup was advantageous. Steam blanching of whole fruits of jackfruit and papaya facilitated dehydration and therefore steamlined.

Report(s) : -  
Papers Published : -

452 Project Title : Natural tannins.  
Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
Project Category : Applied.  
Cost : -  
Duration : October 1980-March 1983.  
Sponsor(s) : Government of Uttar Pradesh.  
Investigator(s) : Revis, B. and others.  
Description : Effects of natural tannins on pathogenic fungi causing spoilage in fruits are being studied in vitro. Some spoilage fungi and a few natural sources of tannins effective against fungi have been identified.

Report(s) : -  
Papers Published : -

453 Project Title : Intermediate moisture food.  
Organisation : Government Fruit Preservation and Canning Institute, 18-B Ashok Marg, Lucknow.  
Project Category : Applied.  
Cost : -  
Duration : 1979-continuing.  
Sponsor(s) : Government of Uttar Pradesh.  
Investigator(s) : Mehta, G.L.; Tomar, G.L.  
Description : Fruits such as apple, pear, plum and apricot are being investigated for the preparation of intermediate moisture foods.

Report(s) : -  
Papers Published : -

454 Project Title : Osmotic dehydration.  
Organisation : Government Fruit Preservation and Canning Institute, 18-B Ashok Marg, Lucknow.  
Project Category : Applied.  
Cost : -  
Duration : 1976-continuing.  
Sponsor(s) : Government of Uttar Pradesh.  
Investigator(s) : Mehta, G.L.; Tomar, M.C.  
Description : The project is concerned with developing a dehydration method using the principle of osmosis for utilisation of cull fruits. The fruits are treated with syrups of various concentrations to reduce the water contents before osmotic dehydration. Currently, the work is underway with muskmelon, peach, pear and plum.

Report(s) : -



- Papers Published : 1. Mehtra, G.L. and Tomar, M.C. Studies on dehydration of tropical fruits in Uttar Pradesh. 2. Guava (*Psidium Guajawa* L.). Indian Food Packer. 34(4); 1980; 8  
 2. Mehta, G.L. and Tomar, M.C. Studies as dehydration of tropical fruits in Uttar Pradesh. 3. Papaya (*Carica Papaya* L.) Indian Food Packer. 34(4); 1980; 12  
 3. Mehta, G.L. and others. Studies on dehydration of tropical fruits in Uttar Pradesh. 4. Pineapple. Indian Food Packer. 36; 1982

455 Project Title : Dehydration of tropical and temperate fruits in Uttar Pradesh.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B Ashok Marg, Lucknow 226 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1975-1979.  
 Sponsor(s) : Government of Uttar Pradesh; Horticulture and Fruit Utilisation Directorate.  
 Investigator(s) : -  
 \*419

456 Project Title : Osmo-air drying of fruits.  
 Organisation : Marathawada Agricultural University; College of Agricultural Technology, Parbhani 431 402; Food Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 4,000/-.  
 Duration : January 1978-January 1979.  
 Sponsor(s) : University.  
 Investigator(s) : Kapse, B.M.; Kulkarni, D.V.  
 \*420

457 Project Title : Modified atmospheric storage of fruits.  
 Organisation : Andhra Pradesh Agricultural University; Fruit Research Station, Sangareddy 502 001  
 Project Category : Applied.  
 Cost : -  
 Duration : Continuing project.  
 Sponsor(s) : ICAR  
 Investigator(s) : Rameshwar, A.; Ismail, S.  
 Description : Fruits were stored in polyethylene bags (+ ventilation, + calcium hydroxide, + ethylene absorbant) to increase the storage life. In guava and passion fruit (yellow) shelf life was increased significantly. In mango, inclusion of calcium hydroxide in the bag and provision of ventilation after 4 days prolonged the storage life considerably. Studies on mango will be continued and storage of custard apple will be taken up shortly.  
 Report(s) : -  
 Papers Published : 1. Rameshwar, A. and others. Modified atmospheric storage and use of ethylene absorbant to prolong storage life of mango fruits. Papers, Mango Workers Meeting, Panaji, Goa (ICAR). 1979; 313  
 2. Rameshwar, A.; Ismail, S. Modified atmospheric storage of mango fruits. Submitted for presentation at All India Workshop on Fruits (ICAR), 1981.  
 3. Ismail, S. and Rameshwar, A. Modified atmospheric storage of guava fruits. Submitted for presentation at All India Workshop on Fruits (ICAR), 1981  
 4. Rameshwar, A. and Rao, D.V. Studies on wax coating and plastic bag storage of yellow passion fruit. Indian Hortic. 27(1-2); 1979; 15

- 458 Project Title : Study of the effect of transportation and packaging material on the storage behaviour of fruits.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow 226 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : June 1977-July 1979.  
 Sponsor(s) : Government of Uttar Pradesh; Horticulture and Fruit Utilization Directorate.  
 Investigator(s) : Garg, R.S. and others.  
 \*423
- 459 Project Title : Changes in fruit pectins during storage.  
 Organisation : Calcutta University; Biochemistry Department; Food Technological Laboratory, 35, B.C. Road, Calcutta 700 019.  
 Project Category : Applied.  
 Cost : Rs. 20,000/-.  
 Duration : March 1976-March 1981.  
 Sponsor(s) : Government of West Bengal, State Planning Board, Calcutta.  
 Investigator(s) : Ghosh, J.J. and others.  
 \*426
- 460 Project Title : Establishment of community canning and fruit preservation centres.  
 Organisation : Government of India; Ministry of Agriculture and Irrigation, Krishi Bhavan, New Delhi 110 001; Department of Food; Food and Nutrition Board.  
 Project Category : Survey.  
 Cost : Rs. 33,00,000/- per annum.  
 Sponsor(s) : 1963-  
 Sponsor(s) : Food and Nutrition Board.  
 Investigator(s) : Dayanand.  
 \*418
- 461 Project Title : Metabolism of acetic acid and other organic acids during low temperature storage and ripening of fruit.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Fruit and Vegetable Technology Discipline.  
 Project Category : Fundamental and Applied.  
 Cost : Rs. 39,000/-.  
 Duration : April 1977-March 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Patwardhan, M.V.; Rama S.B.  
 Description : In mango fruit injected with radio active acetate and glucose at various stages of low temperature storage and ripening, the label distribution of acetate was somewhat similar during both stages. Fatty acid fraction derived more of counts from acetate than glucose. During ripening, the starch grains disappeared and cell walls showed degeneration. Fruit kept at 45-50 F suffered damage. In banana, a 3-fold increase in total amino acid was observed during ripening. Arginine and valine in particular increased from raw to ripe.  
 Report(s) : Final.  
 Papers Published : -  
 \*430
- 462 Project Title : Biochemical changes associated with growth and development of fruits: Banana, mango, grape, pineapple, papaya, sapota and other minor tropical fruits.



Organisation : Indian Institute of Horticultural Research, Bangalore 560 006.  
 Project Category : Fundamental.  
 Cost : -  
 Duration : September 1969-  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Selvaraj, Y. and others.  
 Description : Currently studies on fruit enzyme and biochemistry of uneven ripening in grapes are being conducted.  
 Report(s) : -  
 Papers Published : 1. Lodh, S.B. and others. Biochemical changes associated with growth and development of Dwarf cavendish banana. Indian J. Hort. 28(1); 1971; 38.  
 2. Lodh, S.B. and Selvaraj, Y. Biochemical changes associated with growth and development of grape var. Bangalore Blue Indian J. Hort. 31(3); 1974; 232  
 3. Lodh, S.B. and Selvaraj, Y. Preliminary studies on the separation and identification of anthocyanin pigments in Bangalore Blue grape by paper chromatography. Indian J. Hort. 30(3/4); 1973; 514  
 4. Chadha, K.L. and others. Biochemical changes associated with growth and development of pineapple var. Kew. 1. Changes in physico-chemical constituents. Indian J. Hort. 29(1); 1972; 54  
 5. Lodh, S.B. and others. Biochemical changes associated with growth and development of pineapple var. Kew. 1. Changes in physico-chemical constituents. 2. Changes in carbohydrates and mineral constituents. Indian J. Hort. 29(3/4); 1972; 287

#### Vegetables and Tubers

463 Project Title : Chemical and enzymatic modification of vegetable proteins.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Biochemistry and Applied Nutrition Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 1,77,000/-.  
 Duration : April 1979-March 1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Raghavendra Rao, M.R. and others.  
 Description : The nitrogen content of casein, its tryptic and peptic hydrolysates, trypsin-pepsin and pepsin-pepsin plasteins have been determined. Tryptic and peptic hydrolysates of casein have been used along with groundnut protein as source of lysine peptides. The lysine content of these proteins and their plasteins have been determined. Acetylated and succinylated arachin (acylated to different degrees) were fractionated on Sephadex G-150 columns. It was found that one of the minor components constituting about 11% of the total protein was acylated to the extent of 85.90% and its fluorescence was completely quenched. Succinylated arachin was easily hydrolysed by chymotrypsin and the rate of hydrolysis increased with the degree of succinylation. Acetylated arachin was soluble in the pH range 4-6. Both acetylated and succinylated arachin had greater emulsifying capacity than native arachin.  
 Report(s) : -  
 Papers published : -  
 \*351

- 444 Project Title : Standardisation of conditions for steeping preservation of fresh vegetable suitable for Indian style cooking.
- Organisation : Central Food Technological Research Institute, Experiment Station, Ludhiana 141 006.
- Project Category : Applied.
- Cost : Rs. 40,020/-.
- Duration : May 1976-March 1979.
- Sponsor(s) : Institute.
- Investigator(s) : Pruthi, J.S. and others.
- Description : Cauliflower, turnips, carrots, peas, squash-melon (Tinda), bitter gourd (Karela), cabbage and lady's finger were preserved in different concentrations of brine, acetic acid, citric acid and  $\text{SO}_2$  in glass jars and glazed jars. Storage studies for 10 months at room temperature (13-38 C) indicated that most vegetables remained in good condition except for some change in colour. Fading of colour in squash melon was found to be lesser in glazed jars than in glass jars. The loss of ascorbic acid ranged from 16% (lady's finger) to 83.4% (cauliflower). The leaching of protein into the brine and of total sugars ranged from 27% and 70% (turnip) to 40% and 82.7% (lady's finger) respectively. Washing of the vegetables removed half the microbial load, and in preserved vegetables, during 6 months storage, total viable counts were nil due to high brine concentration and low pH. Curries prepared from the preserved vegetable were acceptable as judged by a sensory panel and rated next only to those from fresh vegetables. Mixed pickles (cauliflower, turnips and carrots) were highly acceptable.
- Report(s) : Final.
- Papers Published : 1. Pruthi, S. and others. Studies on the determination of optimum condition of preservation of fresh vegetable in acidified sulphited brine for subsequent use in Indian style curries. Indian Food Packer. 34(6); 1980; 9

\*381

- 465 Project Title : Screening of new varieties of various vegetables like cauliflower, onion, lady's finger developed by Punjab Agricultural University, Ludhiana, for assessing their quality characteristics and suitability for processing.
- Organisation : Central Food Technological Research Institute, Experiment Station, Ludhiana.
- Project Category : Applied.
- Cost : Rs. 75,000/-.
- Duration : July 1976-July 1979.
- Sponsor(s) : CSIR
- Investigator(s) : Raina, B.L. and others.
- Description : Four varieties of cauliflower, 8 of onions, 12 of okra and 4 of bitter gourd developed by PAU, Ludhiana, were screened. Cauliflower, okra and bitter gourd were both canned and dehydrated, and onion was dehydrated. The products were evaluated for various quality characteristics like chemical and physical characteristics, colour and texture, taste and flavour, etc. Based on the evaluation, the varieties suitable for the two processes were identified.
- Report(s) : Final.
- Papers Published : 1. Pruthi, J.S. and others. Technological assessment of new varieties of okra, bitter gourd, white onions and cauliflowers for processing. Presented at the Annual Meeting of All India Food Preservers Association, New Delhi, November 1980.

\*380, \*\*449



- 466 Project Title : Preservation fresh vegetable with chemical additives.  
 Organisation : Indian Agricultural Research Institute, New Delhi 110 012; Horticulture and Fruit Technology Division.  
 Project Category : Fundamental and applied.  
 Cost : -  
 Duration : 1972-1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Anand, J.C.; Sethi, V.  
 \*382
- 467 Project Title : Dehydration of vegetables.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979-continuing.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Mehta, G.L.; Tomar, M.C.  
 Description : Studies are being conducted on dehydration of vegetables like bitter gourd and string beans particularly in regard to retention of green colour during dehydration.  
 Report(s) : -  
 Papers Published : -
- 468 Project Title : Survey on post-harvest problems of vegetables grown in AP with respect to their production, handling, transportation and keeping quality in different seasons.  
 Organisation : Central Food Technological Research Institute, Experimental Station, Hyderabad.  
 Project Category : Survey.  
 Cost : Rs. 67,400/-.  
 Duration : August 1980-July 1982.  
 Sponsor(s) : CFTRI Experiment Station, Hyderabad.  
 Investigator(s) : Krishnamurthy, G.V. and others.  
 Description : Leafy vegetables like palak, Amaranthus, coriander and curry leaves and common vegetables like lady's finger, brinjal tomato, green chillies, french beans and coccinia are subjected to various packing conditions at the ambient temperature. The different packaging systems studied were control, covered with wet cloth; packed in gunny bag, packed in 250 guage PE bag; packed in 250 guage PE bag with pin holes; packed in 250 guage PE beg with punch holes; kept in dessicator under 5" vacuum and packed in PE bag and kept in refrigerator.  
 Report(s) : -  
 Papers Published : -
- 469 Project Title : Studies on determination of thermal process schedule for indigenous vegetables, development of newer techniques and approaches to conservation of energy.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Fruit and Vegetable Technology.  
 Project Category : Applied.  
 Cost : Rs. 55,000/-.  
 Duration : August 1982-July 1985.  
 Sponsor(s) : Institute.  
 Investigator(s) : Ranganna, S. and others.  
 Description : The project aims to develop thermal process schedule for canned indigenous vegetables aimed at certification of low-acid foods exported to European and American markets; to develop process schedule for indigenous acidified vegetables,

aimed at quality improvement and minimization of energy requirements - a practice already accepted under FDA regulations; to work out bulk sterilization and subsequent packaging techniques to low-acid foods to obviate the need for use of retortable pouches and specialized retorts which would enable the Indian canneries to pack foods in flexible pouches and minimize energy consumption; to work out procedure for packing presterilized juices in flexible pouches; to work out aseptic packaging conditions in consumer packs or bulk containers for pulps to meet export market requirement.

Report(s) : -  
Papers Published : -

### Onion

- 470 Project Title : Studies on onion storage.  
Organisation : Punjab Rao Krishi Vidyapeeth, Akola-444 104; Harvest and post harvest technology scheme.  
Project Category : Applied.  
Cost : Rs. 79,000/-.  
Duration : 1980-1983.  
Sponsor(s) : Indian Council of Agricultural Research and Government of Maharashtra.  
Investigator(s) : Korde, P.D. and others.  
Description : Different methods of storage are being studied to suggest the best method which can help to maintain good shelflife and quality.  
Report(s) : -  
Papers Published : -
- 471 Project Title : Studies on chemical, technological and storage aspects of onion.  
Organisation : Central Food Technological Research Institute, Experiment Station, Nagpur.  
Project Category : Applied.  
Cost : Rs. 1,64,150/-.  
Duration : June 1980-December 1983.  
Sponsor(s) : Institute.  
Investigator(s) : Laul, M.S. and others.  
Description : Several varieties of onions of the region were surveyed for the storage life. Nasik red varieties tried in the survey were suitable for storage when the neck was tight and the outer scales were dry and rustle when handled. Of the eight different curing methods tried, leaf cover method (natural) and bunch hanging were found optimal for the onions from 3 seasons from the point of view of colour retention, pungency and wastage reduction during storage. Optimum moisture loss at the end of curing for 2-4 days was found to be 5 to 6%. Storage studies of cured onion in crates at a model store house in batches of 50 kg, 250 and 500 kg conducted for 4, 5½ and 3½ months confirmed the above findings. A tier type storage structure for storing cured onions in large scale has been suggested.  
Report(s) : -  
Papers Published : -
- 472 Project Title : Preparation of onion and garlic products and their chemical examination.  
Organisation : Central Food Technological Research Institute, Mysore-570013; Plantation Products and Flavour Technology Discipline.



- Project Category : Applied.  
 Cost : Rs. 20,000/-.  
 Duration : October 1979-April 1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Shankaranarayana, M.L. and others.  
 Description : The effect of temperature, mesh size and initial moisture content versus caking, with and without the incorporation of tri-calcium phosphate and other permitted anticaking agents are studied. Garlic oil preparation using 20 kg and more material by steam distillation is studied. Onion and garlic juice concentrates using aroma recovery unit and natural fried onion aroma blended with caramel are prepared. Chromatographic analysis of the flavours are done.
- Report(s) : -  
 Papers Published : -
- 473 Project Title : Post harvest physiology of onion.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981-82-1982-83  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Ram, H.B. and others.  
 Description : Onions are susceptible for losses during storage due to factors such as sprouting and microbial decay. Therefore, post harvest treatment with M-40 is being studied for its effect on the storage behaviour at room and low temperature.
- Report(s) : -  
 Papers Published : -
- 474 Project Title : Studies on some chemical aspects of gamma-irradiated onions.  
 Organisation : Bhabha Atomic Research Centre, Bombay - 470 085.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Tewari, G.M.; Bandyopadhyay, C.  
 Description : Freshly harvested red globe onions were irradiated at doses of 6,10,20 and 50 Krad and stored at ambient temperature (30-40C) for 3 months along with unirradiated control samples. A comparative study of volatile flavour compounds and some nonvolatile constituents of control and irradiated samples were carried out with the help of gas liquid chromatography, thin-layer chromatography and infra-red spectroscopy. The results suggest that there is no effect of gamma-irradiation upto a dose of 50 Krad on freshly harvested red globe onions with respect to chemical parameters studied.
- Report(s) : -  
 Papers Published : 1. Bandyopadhyay, C. and others. Studies on some chemical aspects of gamma-irradiated onions. Radiation Preservation of Food, IAEA, Vienna, 1973, pp.11
- 475 Project Title : Sprout inhibition in onions by gamma irradiation.  
 Organisation : Bhabha Atomic Research Centre, Bombay - 470 085.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.

- Investigator(s) : Thomas, P. and others.  
 Description : Sprout inhibition of onions by gamma-irradiation was found to be influenced by the physiological state of the bulbs at the time of irradiation, radiation dose and the storage temperature. Sprouting was minimal at higher ambient temperatures (26-32C) while low temperatures (4-20 C) or fluctuating diurnal temperatures (20 C min-30 C max.) accelerated it. 6-9 krad applied to bulbs within a fortnight of harvest showed good sprout suppression. A localized internal discolouration can occur in irradiated onions which is due to death of internal meristem tissue or to degenerating internal sprouts. Field trials under commercial storage conditions in Lasalgaon and Pimpalgaon in Nasik Dt., Maharashtra State have shown that an additional 15-20% of the initial quantity stored could be saved by irradiation during 3-4 months storage. Large scale storage experiments in collaboration with NAFED are in progress at Pimpalgaon to evaluate the economic benefits of irradiation processing for onion storage. Irradiation did not affect the quality of the onions as judged by the changes in pungency, lachrymatory principles, soluble sugars and anthocyanin pigments, during storage.
- Report(s) : -  
 Papers Published : 1. Thomas, P. and others. Sprout inhibition of onions by gamma irradiation. 1. Influence of time interval between harvest and irradiation, radiation dose and environmental conditions on sprouting. Radiation Botany 15; 1975; 215
- 476 Project Title : Studies on flavour components of onion.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Tewari, G.M.; Bandyopadhyay, C.  
 Description : Pungency and lachrymatory factor were evaluated in onions by chemical and chromatographic methods. Sprouting of onions caused flavour strength. Lachrymatory precursor accumulated more in sprouts than in bulbs suggesting that the sprouts could be a source for isolating the onion flavour. Flavour strength of three varieties (red globe, white globe and Madras) varied, the last one having higher lachrymators with less pungent principles than the other two varieties. Lachrymatory components were isolated from ether extract of fresh onion by Thin-layer chromatography and characterised as thiopropanal S-oxide and its isomer including a dimer with the help of infrared spectroscopy. Onion lachrymators exhibited antibacterial, antifungal as well as antitumoral activities.
- 12 papers published.



## Tubers

- 477 Project Title : Utilisation of roots and tubers in the dietaries.  
 Organisation : University of Agricultural Sciences, Bangalore 560 024; Home Economics Department.  
 Project Category : Applied.  
 Cost : Rs. 25,000/-.  
 Duration : April 1978-April 1979.  
 Sponsor(s) : University.  
 Investigator(s) : Vaidehi, M.P.  
 \*386
- 478 Project Title : Utilisation of tubers and root vegetables in the dietaries: Incorporation of tubers such as tapioca, sweet potato and potato in selected food preparations.  
 Organisation : Punjab Agricultural University; College of Home Science, Ludhiana 141 004; Food and Nutrition Department.  
 Project Category : Applied.  
 Cost : Rs. 25,000/-.  
 Duration : February 1978-February 1979.  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Bajaj, S.  
 \*387
- 479 Project Title : Nutritive value of tubers of Eleocharis and Sagitaria.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad-500007.  
 Project Category : Fundamental.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : These tubers are eaten in certain parts of the country particularly in the North Eastern Region. The tubers of Sagitaria are boiled or deep fried and eaten with rice; those of Eleocharis are sweet and consumed either in raw form or cooked. The nutrient compositions of these tubers were therefore studied and the results indicated the sugar concentration was higher in Eleocharis which explained its sweetness. One species, E. kuroguwai had as much as 85% starch. Both tubers had fairly high amounts of nicotinic acid (3.5-7.3 mg/100 g). This apart, the nutrient composition of these tubers was comparable to other commonly consumed tubers like colocasia, tapioca and sweet potato. Sagitaria tubers contained relatively higher amounts of Mg, Zn and M than Eleocharis.  
 Report(s) : Annual.  
 Papers Published : -
- 480 Project Title : A study on the current methods of preparation and preservation of tubers by indigenous methods in Kerala State.  
 Organisation : Kerala Agricultural University; College of Agriculture, Vellayani, Trivandrum 695 522; Department of Agricultural Extension, Food Science and Nutrition Section.  
 Project Category : Survey.  
 Cost : Rs. 200/-  
 Duration : 1978-1980.  
 Sponsor(s) : University.  
 Investigator(s) : Prema, L. and others.  
 Description : A questionnaire survey was conducted and data were collected from 250 rural women belonging to families of marginal income

in Trivandrum and Quilon Districts. An analysis of the data unfolded the fact that cassava is used as a daily main dish 39% of the respondents and as a side dish by 42% of the respondents; the method of cooking and processing is different according to the type of the preparation; and only very few preparations were made with cassava. The project therefore has formulated 180 new recipes with cassava and a book on the Indian dishes with cassava is being published. The HCN content of cassava has been analysed and the effect of cooking on it has also been investigated.

- Report(s) : Report submitted to the Director of Res; KAV, Vellanikkara, Trichur Dist.
- Papers Published : 1. Prema, L. and others. A survey on the conventional methods of preparation and preservation of cassava tubers in Trivandrum and Quilon districts. Proceedings of the seminar on post-harvest technology of cassava. 1980; p 1
2. Vimalakumari, N.K. and others. Effect of different treatment in cooking on the HCN content of cassava. Proceedings of the seminar on post harvest technology of cassava. 1980;89
3. Vimalakumari, N.K. and others. Standardization of new recipes with fresh cassava. Proceedings of the seminar on post harvest technology of cassava. 1980; 104

\*389

- 481 Project Title : Protease inhibitors and proteases in plant tubers.
- Organisation : Kasturba Medical College, Manipal 576 119; Department of Biochemistry.
- Project Category : Exploratory.
- Cost : Rs. 1,20,000/-.
- Duration : 1980-1983.
- Sponsor(s) : Department of Science and Technology, Government of India.
- Investigator(s) : Pattabiraman, T.N. and others.
- Description : The project aims to study the role of enzyme inhibitors in plant tubers like yam, arrowroot, white bean, etc. with special reference to their action on human enzymes. The biological role of inhibitors and their activity as storage proteins are investigated. Unusual inhibitors like enterokinase/trypsin inhibitors from the plant tubers are isolated and characterized.
- Report(s) : Two project reports.
- Papers Published : 1. Bhat, P.G. and others. Enzyme inhibitors from plants. Enterokinase inhibitors in tuber seeds. J. Biosciences. 3; 1981; 371
2. Krishna Sharma and others. Natural plant enzyme inhibitors: isolation and characterization of an  $\alpha$ -amylase inhibitor from yam. J. Sci. Food Agric. 33(3); 1982; 255
3. Krishna Sharma, K. and others. An affinity chromatographic method for the isolation of pancreatic amylases using yam amylase inhibitor. (Communicated)

#### Potato

- 482 Project Title : Suitability of the newly evolved high yielding varieties of potatoes for different types of processing.
- Organisation : Central Potato Research Institute, Simla 171 001.
- Project Category : Applied.
- Cost : -
- Duration : 1974-continuing.
- Sponsor(s) : ICAR
- Investigator(s) : Grewal, S.S. and others.



- Description : Several varieties of high-yielding new varieties are being studied for their suitability for dehydration and chipping
- Report(s) : Annual report.
- Papers Published : -
- \*392
- 483 Project Title : Assessment of quality in potatoes.
- Organisation : Central Potato Research Institute, Simla 171 001.
- Project Category : Applied.
- Cost : -
- Duration : 1967-continuing.
- Sponsor(s) : ICAR
- Investigator(s) : Verma, S.C. and others.
- Description : Earlier, relationship between specific gravity and dry matter content of potatoes from different regions of the country was worked out. It was observed that the specific gravity was positively related to the dry matter and starch content but negatively related to nitrogen content. Recently, it was revealed that application of potassic fertilisers decreased the enzymic browning, contents of phenolic compounds, and cresolase and catacholase activities of tuber tissues. There was also an increase in the content of potassium in the tissue. Further work will be to investigate the effects of nitrogenous and phosphatic fertilisers on the quality of potatoes as also to study some enzymes in relation to quality aspects.
- Report(s) : Annual report.
- Papers Published : -
- \*396.
- 484 Project Title : Investigation of sundrying of potatoes.
- Organisation : Central Potato Research Institute, Simla 171 001.
- Project Category : Applied.
- Cost : -
- Duration : 1971-.
- Sponsor(s) : Indian Council of Agricultural Research, New Delhi.
- Investigator(s) : Verma, S.C. and others.
- \*393
- 485 Project Title : Wound healing in potato tubers.
- Organisation : Bhabha Atomic Research Centre, Bombay.
- Project Category : Applied and basic.
- Cost : -
- Duration : 1979- continuing.
- Sponsor(s) : Centre.
- Investigator(s) : Thomas, P.; Joshi, M.R.
- Description : The wound-induced suberization and periderm development, the processes of wound healing, in potato tubers was found to occur most rapidly at 25 C while a temperature of 35 C prevented periderm formation and retarded suberization. Irradiation upto 10 Krad did not affect suberization whereas 2-3 Krad was sufficient to inhibit the wound periderm formation. Selection of properly cured tubers and careful handling to avoid mechanical damage during irradiation processing and subsequent storage are very important for minimising microbial spoilage in tubers during storage. Quantitative and qualitative changes in the phenolic and lipid components synthesized in the suberizing layers in response to wounding in irradiated tubers are being studied to understand the role of suberization in disease resistance.

- Report(s) :  
Papers Published : Thomas, P. Wound-induced suberization and periderm development in potato tubers as affected by temperature and gamma-irradiation. Potato Res. (In press).
- 486 Project Title : Generation of technical and economic data relating to production of potato products using solar drying methods.  
Organisation : Central Food Technological Research Institute, Experiment Station, Lucknow.  
Project Category : Applied.  
Cost : Rs. 4,000/-.  
Duration : February 1981-April 1982.  
Sponsor(s) : Institute.  
Investigator(s) : Saha, N.K. and others.  
Description : Standardization of methods of sundrying for making various products like potato slices, fingers, papads and extruded products using economical solar driers and also open sundrying has been carried out. Conditions for pretreatment of potatoes and varietal requirements were also included in the study. The time, temperature and the quality of the final product were studied, as also the economics of their production and packaging.  
Report(s) : Final.  
Papers Published : -
- 487 Project Title : Post-harvest physiology of potatoes.  
Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
Project Category : Applied.  
Cost : -  
Duration : 1981/82-1982/83  
Sponsor(s) : Government of Uttar Pradesh.  
Investigator(s) : Ram, H.B. and others.  
Description : Potatoes are stored and transported in large quantities during which they may suffer losses. This project is concerned with the study of the effect of tuber size and mechanical injuries on the storage behaviour of potatoes at room temperature.  
Report(s) : -  
Papers Published : -
- 488 Project Title : Biochemical aspects of sprout inhibition in gamma irradiated potatoes.  
Organisation : Bhabha Atomic Research Centre, Bombay 470 086.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Centre.  
Investigator(s) : Nair, P.M. and others.  
Description : The purpose of gamma irradiation has been to prolong the state of dormancy in potatoes. During dormancy the genome is repressed with inhibited synthesis of DNA and RNA. The mechanism of sprouting inhibition could be correlated with increased asparagine synthetase activity localised in the nuclei. This inhibition was apparently due to de novo synthesis of the enzyme which was observed. Gamma irradiation seemed to activate dormant potato genome to synthesise new RNA. Dormant potato buds have limited capacity for both DNA dependent RNA synthesis and DNA replication. Actinomycin D inhibited radiation induced synthesis of both RNA and DNA.



- Report(s) : -
- Papers Published : 1. Nair, P.M. Arch. Biochem. Biophys. 133; 1969; 208  
 2. Nair, P.M. and Sreenivasan, A. Indian J. Biochem. Biophys. 8; 1970; 204  
 3. Nair, P.M. Biochem. J. 128; 1972; 24  
 4. Nair, P.M. FEBS Letters. 30; 1973; 61  
 5. Nair, P.M. and Shirsat, S.G. Biochem. Biophys. Res. Commun. 55; 1973; 588  
 6. Satyaranayana, V and Nair, P.M. Ind. J. Biochem. Biophys. 15; 1978; 25  
 7. Nair, P.M. and Ussuf, K.K. Ind. J. Exptl. Biol. 17; 1979; 1480
- 489 Project Title : Biochemical identification of irradiated potatoes.  
 Organisation : Bhabha Atomic Research Centre, Bombay 470 086.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Shirsat, S.G.; Nair, P.M.  
 Description : The increased activity of phenylalanine ammonia lyase (PAL) induced by gamma irradiation could be used as a parameter for distinguishing irradiated potatoes from unirradiated ones.
- Report(s) : -
- Papers Published : 1. Thomas, P. and others. Proceedings of the FAO/IAEA International Symp. on Food Preservation by Irradiation Wageningen, 1977.
- 490 Project Title : Phenylalanine ammonia lyase (PAL) in irradiated potatoes.  
 Organisation : Bhabha Atomic Research Centre, Bombay - 470 085.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Nair, P.M.; Pendharkar, M.B.  
 Description : Gamma irradiation induced phenylalanine ammonia lyase which is involved in the biosynthesis of phenolic compounds in potatoes. It was therefore apparent that the phenolic compounds are retained in potatoes to inhibit the growth of toxigenic fungi even after irradiation.
- Report(s) : -
- Papers Published : 1. Pendharkar, M.B. and Nair, P.M. Radiation Bot. 15; 1975; 191
- 491 Project Title : Molecular aspects of sprout inhibition in gamma irradiated potatoes.  
 Organisation : Bhabha Atomic Research Centre, Bombay 470 085.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Nair, P.M.; Ussuf, K.K.  
 Description : Gamma irradiation has resulted in enhanced RNA synthesis. Among the newly synthesised RNAs, substantial amount of m-RNA was also synthesised in irradiated potatoes. Two specific m-RNAs which code for phenyl alanine ammonia lyase and amidating enzyme was characterised from irradiated potatoes.
- Report(s) : -
- Papers Published : Ussuf, K.K. and Nair, P.M. Ind. J. Biochem. Biophys. 1 276

- Project Title : Correlation of solanine formation with chlorophyll synthesis in greening potato.
- Organisation : Bhabha Atomic Research Centre, Bombay 470 045.
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : Centre.
- Investigator(s) : Nair, P.M.; Ramaswamy, N.K.
- Description : Isolated chloroplasts could incorporate  $^{14}\text{C}\text{O}_2$  into solanidine moiety only in the presence of light. The chloroplast system could also incorporate the known precursors of steroid synthesis, namely acetate and mevalonate, with solanidine. Formate was identified as the primary product of  $\text{CO}_2$  fixation. Glycine, serine and pyruvate were identified as possible routes for conversion of formate to acetate. This conversion was dependent upon pyridoxyl phosphate the presence of which was demonstrated. Isonicotinic acid hydrazide completely inhibited  $^{14}\text{C}$ -formate into mevalonate.
- Report(s) : -
- Papers Published : 1. Ramaswamy, N.K. and others. Eur.J. Biochem. 67; 1976; 275
- 493 Project Title : After-cooking darkening in potatoes.
- Organisation : Bhabha Atomic Research Centre, Bombay.
- Project Category : Applied and basic.
- Cost : -
- Duration : 1975-1981.
- Sponsor(s) : Centre.
- Investigator(s) : Thomas, P.; Joshi, M.R.
- Description : Most of the Indian potato varieties on exposure to 10 krad of gamma rays for sprout inhibition showed a tendency to develop after cooking darkening, the intensity of which varied with the variety, temperature and storage period. Evidence indicate that the darkening is due to the interaction of  $\text{Fe}^{++}$  and phenolics present in the tuber and is influenced by the pH and citric acid content. This irradiation induced after cooking darkening appears to be of a similar nature to that occurring in certain naturally darkening potato varieties. The darkening could be prevented or reduced by removal of peel prior to boiling, soaking and boiling in dilute solutions of citric acid, acetic acid or EDTA. Keeping the boiled tubers under anoxic conditions also prevent the formation of the dark coloured  $\text{Fe}^{+++}$  - phenolics complex.
- Report(s) : -
- Paper Published : 1. Thomas, P. and Joshi, M.R. Prevention of after-cooking darkening of irradiated potatoes. Potato Res. 20; 1977; 77  
2. Thomas, P. Involvement of polyphenols in the after-cooking darkening of gamma irradiated potatoes. J. Food Sci. 46, 1981, 1620
- 494 Project Title : Storage changes in commercial varieties of potatoes.
- Organisation : Bhabha Atomic Research Centre, Bombay.
- Project Category : Applied.
- Cost : -
- Duration : 1970-1976.
- Sponsor(s) : Centre.
- Investigator(s) : Thomas, P. and others.
- Description : The storage behaviour of several important commercial varieties of potatoes subjected to gamma irradiation (10 krad) were compared with non-irradiated tubers at different temperatures (4 to 32 C). Bacterial soft rot due to Erwinia carotovora



caused 30 to 70% losses during 2 to 4 months storage at room temperature (RT, 27-32 C). Sodium hypochlorite wash or increased ventilation did not reduce the soft rot at RT. Storage at 10 to 15 C markedly reduces the soft rot but accelerates sprouting. Irradiation irreversibly inhibits sprouting regardless of storage temperature and also eliminates the egg and early larval instars of the tuber moth Phthorimaea operculella Zether. The high incidence of bacterial soft rot at RT necessitates cool storage (10-15 C) of irradiated potatoes. The changes in ascorbic acid and soluble sugars during storage at RT and 15 C were comparable in both irradiated and nonirradiated tubers. Temperature and irradiation affected the carotenoid levels in tuber flesh, more loss being observed in irradiated tubers at 15 C.

- Report(s) : -
- Papers Published : 1. Thomas, P. and others. Feasibility of radiation processing for post-harvest storage of potatoes under tropical conditions. In "Food Preservation by Irradiation", Vol.1; International Atomic Energy Agency, Vienna pp.71-82.
2. Thomas, P. and others. Storage deterioration in gamma irradiated and unirradiated Indian potato cultivars under refrigeration and tropical temperatures. Potato Res. 22; 1979; 261
3. Janave, M.T. and Thomas, P. Influence of post-harvest storage temperature and gamma irradiation on potato carotenoids. Potato Res. 22; 1979; 365
- 495 Project Title : Standardisation of method for preparation of potato granules.
- Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.
- Project Category : Applied.
- Cost : -
- Duration : 1981-1984.
- Sponsor(s) : Government of Uttar Pradesh.
- Investigator(s) : Kapur, K.L. and others.
- Description : Potato granule is an important export item. This study involves standardisation of the process for potato granules which would provide a useful means for utilisation of cell potatoes. The granules will also be studied for their storage life.
- Report(s) : -
- Papers Published : -
- 496 Project Title : Studies on the utilisation of potatoes in the production of instant mashed potato tikki.
- Organisation : Central Food Technological Research Institute, Experiment Station, Ludhiana-6.
- Project Category : Applied.
- Cost : Rs. 10,000/-.
- Duration : July 1979-May 1980.
- Sponsor(s) : Institute.
- Investigator(s) : Raina, B.L. and others.
- Description : The product analysis showed wide variations in the physicochemical characteristics of the commercial samples of potato tikki (a popular potato based spiced snack food of North India prepared from mashed potatoes with or without stuffing with dals, peas, spices, etc. and heated on iron pan smeared with suitable edible oil or deep-fat fried). The quality of the tikki was dependent on potato dough quality, frying time, frying temperature and quantity and quality of oil used or impregnated. For

good quality potato tikki, the optimum frying time was three minutes on each side and the optimum oil uptake was 6.4-8.5%. Dry mix for tikki was prepared by blanching potato slices of different thickness for 2 minutes at 90 C and dehydrating in a cross flow-drier at 60 C. Potato flavour was good in tikki prepared from drum dried powder but tikki prepared from dried slices and powders lacked flavour. Addition of 0.05-0.10% of sodium glutamate improved its flavour.

Report(s) : -  
Papers Published : -

### Sweet potato

497 Project Title : Studies on the preparation of sweet potato flour.  
Organisation : Tamil Nadu Agricultural University, Coimbatore-641003;  
Department of Food Technology.  
Project Category : Applied.  
Cost : Rs. 1,000/-.  
Duration : April 1980-April 1983.  
Sponsor(s) : University.  
Investigator(s) : Neelakantan, S.; Manimegalai, G.  
Description : In Tamil Nadu, sweet potato is cultivated in 7735 hectares with an annual production of 66,620 tonnes. This is utilised only in the fresh form but not in preserved form. If proper processing methods are developed it can be utilised in the off season not only in the homes but also in the food industries for various food preparations. The sweet potato flour under development will have good storage life and result in better utilisation of the tuber.

Reports(s) : -  
Papers Published : -

498 Project Title : Utilisation and acceptability of sweet potato flour.  
Organisation : Tamil Nadu Agricultural University, Coimbatore-641 003;  
Department of Food Technology.  
Project Category : Applied.  
Cost : Rs. 1,000/-.  
Duration : April 1980-April 1983  
Sponsor(s) : University.  
Investigator(s) : Neelakantan, S.; Manimegalai, G.  
Description : Sweet potato flour will be used to prepare various dishes, separately or incorporated with other starches like rice, wheat, jowar, etc. The Flour will be used in foods like dried, bakery, etc. and efforts will be made to popularise the products.

Report(s) : -  
Papers Published : -

### Tapioca

499 Project Title : Technology of tapioca and other tubers.  
Organisation : Regional Research Laboratory, Trivandrum-19.  
Project Category : Applied.  
Cost : Rs. 5 lakhs.  
Duration : 1979-1983.  
Sponsor(s) : Council of Scientific and Industrial Research  
Investigator(s) : Raja, K.C.M. and others.  
Description : The project attempts to improve the texture of tapioca flour for edible uses and to study the physicochemical characteristics of tubers other than tapioca in relation to their processing



and storage qualities. It also investigates into the utilisation of by products and waste residues formed during processing.

- Report(s) : -
- Papers Published : 1. Emilia Abraham and others. Chemistry and Technology of cassava. Indian Food Packer. 33(3); 1979; 31 )
2. Raja, K.C.M. Post-harvest storage of cassava tubers under modified environmental conditions. J. of Root Crops. 4(1); 1978; 1
3. Emilia Abraham and others. A comparative study of the physicochemical and cooking characteristics of different varieties of cassava. (Communicated)
4. Raja, K.C.M. and others. Effect of fractional sieving on some quality aspects of cassava flour. J. Root Crops. 4(2); 1978; 17
5. Emilia Abraham and others. Improvement of texture of cassava flour by chemical treatment. J. Root Crops. 5(1/2); 1979; 11
6. Mathew, A.G. Tapioca - present and future status. Economic Times, 1980; 17th Feb.
- 500 Project Title : Technological improvement of tapioca.
- Organisation : CSIR Trivandrum Complex, Industrial Estate, P.O., Papanamcode. Trivandrum 695 019.
- Project Category : Applied.
- Cost : -
- Duration : 1976-1979.
- Sponsor(s) : Council of Scientific and Industrial Research, New Delhi.
- Investigator(s) : Mathew, A.G.; Raja, K.C.M.
- \*405
- 501 Project Title : A study of the shelf-life of preserved tapioca and sweet potato by different indigenous methods in Kerala State.
- Organisation : Kerala Agricultural University: College of Agriculture, Vellayani, Trivandrum 695 522; Department of Agricultural Extension, Food Science and Nutrition Section.
- Project Category : Survey and exploratory.
- Cost : Rs. 5,000/-.
- Duration : 1978-1982.
- Sponsor(s) : University.
- Investigator(s) : Prema, L.; Vimalakumari, N.K.
- Description : The project aims to find out the changes in moisture, colour, smell, taste, texture presence of weevils, and fungal growth in the processed cassava and sweet potato changes during storage. The acceptability of the chips among the farmer community are evaluated and the improved methods of processing and preservation of these crops are suggested.
- Report(s) : -
- Papers Published : 1. Prema, L. and others. Storage of different types of chipped cassava. Proceedings of the Seminar on Post-Harvest Technology of cassava; 1980; 43
- \*406
- 502 Project Title : Studies on tapioca processing, waste utilisation for glucose/ alcohol production.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Microbiology and Fermentation Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 1,47,000/-.

Duration : April 1980-March 1982.  
 Sponsor(s) : Institute.  
 Investigator(s) : Gildyal, N.P. and others.  
 Description : Tapioca processing waste residue contained 60-65% of starch on dry basis. Hydrolysis by both acid-enzyme and enzyme-enzyme processes gave conversion of 90-98% on starch basis. Methods were developed for bleaching/clarification and concentration of the hydrolysate. The hydrolysate was tried for alcohol and SCP production by fermentation using Saccharomyces cerevisiae F-18 for conversion. Laboratory studies indicated a recovery of 300-400 g of alcohol per kg of dry waste. In regard to SCP production, 14 different strains were screened, and Candida utilis 3336 and Saccharomyces cerevisiae RM gave 50% and 45% yields (based on sugar utilised) respectively. A process for the production of glucose syrup from tapioca waste was also investigated and parameters were standardised.  
 Report(s) : -  
 Papers Published : 1. Kunhi, A.A.M. and others. Studies on production of alcohol from saccharified waste residue from cassava starch processing industries, Die Starke. 33(8); 1981; 275  
 2. Sreekantiah, K.R. and Satyanarayana Rao, B.A. Production of ethyl alcohol from tubers. J. Food Sci. Technol. 17; 1980; 134

### Sago

503 Project Title : Sago fortification project, Salem.  
 Organisation : Government of India, Ministry of Agriculture and Irrigation, Krishibhavan, New Delhi- 110 001; Department of Food; Nutrition Board.  
 Project Category : Fundamental and Applied.  
 Cost : Rs.10,00,000/-.  
 Duration : 1973-1980.  
 Sponsor(s) : Food and Nutrition Board.  
 Investigator(s) : Thakkar, R.K. (Sago Fortification Project, Salem.)  
 \*407

504 Project Title : Studies on the fortification of sago with vitamins and minerals and to prepare tapioca based fruit flakes.  
 Organisation : Tamil Nadu Agricultural University; Agricultural College and Research Institute, Coimbatore 641003; Food Technology Department  
 Project Category : Applied.  
 Cost : Rs.65,000/-.  
 Duration : June 1974 - June 1979  
 Sponsor(s) : University  
 Investigator(s) : Neelakantan, S. and others.  
 \*408

### Green Vegetable

505 Project Title : Nutritional studies on edible leaves in Kerala State.  
 Organisation : Kerala Agricultural University, College of Agriculture, Vellayani, Trivandrum 695 522; Department of Agricultural Extension, Food Science and Nutrition Section.  
 Project Category : Applied.



- Cost : Rs. 4,500/-.
- Duration : 1981-1985.
- Sponsor(s) : University.
- Investigator(s) : Vimalakumari, N.K. and others.
- Description : The project intends to estimate the nutritional composition of edible leaves at different stages of maturity; their organoleptic quality in different seasons; the effect of different methods of cooking on the nutritional composition and palatability; and the effect of supplementary diets incorporating edible leaves on the nutritional status of pre-school children.
- Report(s) : -
- Papers Published : -
- 506 Project Title : Characterisation of leaf protein concentrate.
- Organisation : Tamil Nadu Agricultural University; Agricultural College and Research Institute, Coimbatore 641 003; Biochemistry Department.
- Project Category : Applied.
- Cost : Rs. 2,000/-.
- Duration : July 1979-June 1982.
- Sponsor(s) : University
- Investigator(s) : Parvathy, K.
- Description : The project aims to study the white protein and saponin from leucerne. This will involve preparation of saponin extract and white protein isolate from leucerne, evaluate these materials by feeding to rats and estimating lipid and cholesterol in liver, serum and faeces.
- Report(s) : -
- Papers Published : -

### Tomato

- 507 Project Title : Post-harvest physiology of tomatoes.
- Organisation : Government Fruit Preservation and Canning Institute, 18-B Ashok Marg, Lucknow.
- Project Category : Applied.
- Cost : -
- Duration : 1981/82-1982/83
- Sponsor(s) : Government of Uttar Pradesh.
- Investigator(s) : Ram, H.B. and others.
- Description : Tomatoes harvested at the breaker and tuning stage of maturity were treated with hot water (41-42 C) for different periods and analysed during storage. It was found that hot water treatment was quite effective in enhancing the ripening process and increasing the lycopene contents. Similar studies will be conducted on several high yielding varieties of tomato.
- Report(s) : -
- Papers Published : -
- 508 Project Title : Study of the suitability of different varieties of tomato for making paste.
- Organisation : Rajendra Agricultural University; Bihar Agricultural College, Sabour, Bihar; Fruit Preservation Laboratory.
- Project Category : Applied.
- Cost : -
- Duration : February 1975-February 1979.
- Sponsor(s) : University.
- Investigator(s) : Singh, R.K. and others.

## Chilli

- 509 Project Title : Storage studies on red chillies.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981-continuing.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Mehtha, G.L.; Tomar, M.C.  
 Description : Storage of red chillies are important as its availability is only seasonal. The studies are concerned with ways and means of storing the product and its behaviour during storage.  
 Report(s) : -  
 Papers Published : -
- 510 Project Title : Investigation on chilli mosaic.  
 Organisation : Tamil Nadu Agricultural University; Agricultural College and Research Institute, Madurai 625 104; Plant Pathology Department.  
 Project Category : Applied.  
 Cost : Rs. 2,000/- per annum.  
 Duration : September 1974-.  
 Sponsor(s) : University  
 Investigator(s) : Alagianagalingam, M.N.  
 \*415
- 511 Project Title : Studies on chilli drying.  
 Organisation : Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal 462 010.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977-1978.  
 Sponsor(s) : ICAR  
 Investigator(s) : Singh, H.P.  
 Description : Chilli is generally harvested at a moisture content of 70-80% weight basis and has to be dried to 10% moisture level for safe storage. The common method is sun drying on mud floor or on the cot. In view of the desirability of reducing drying time, seven surfaces for drying were studied, viz. tarpaulin, jute matting black and white polyethylene, canvas cloth concrete surface and mud floor (control). Results showed tarpaulin surface (as compared to mud surface) resulted in a saving of 21% of drying time, required to reduce the moisture from 80.9% to 13%. As this was not a substantial reduction a new project was taken up to design a solar cabinet dryer.  
 Report(s) : -  
 Papers Published : -

## Pointed gourd

- 512 Project Title : Preservation of parwal (*Tricosanthus dioica*).  
 Organisation : Rajendra Agricultural University; Bihar Agricultural College, Sabour, Bihar; Fruit Preservation Laboratory.  
 Project Category : Applied and Exploratory.  
 Cost : -  
 Duration : May 1976-May 1979.  
 Sponsor(s) : University.  
 Investigator(s) : Singh, R.K. and others.  
 \*417



## Dates

513 Project Title : Thinning of dates.  
 Organisation : Regional Fruit Research Station, Abohar 152 116.  
 Project Category : Applied.  
 Cost : Rs. 1,50,000/-.  
 Duration : July 1977-June 1982.  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Gupta, M.R.  
 \*431

## Grapes

514 Project Title : Evaluation of indigenous and exotic grape varieties and new hybrids for wines, juice and raisin production.  
 Organisation : Indian Institute of Horticultural Research, Bangalore-560 006.  
 Project Category : Applied.  
 Cost : -  
 Duration : August 1970-  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Ethiraj, J.S.; Suresh, E.R.  
 \*432

515 Project Title : Studies on dehydration of fruits (grapes) using a prototype cabinet dehydrator.  
 Organisation : University of Agricultural Sciences, G.K.V.K. Campus, Bangalore 560 065; Agricultural Engineering Department.  
 Project Category : Applied.  
 Cost : Rs. 1,60,000/-.  
 Duration : 1978-  
 Sponsor(s) : University.  
 Investigator(s) : Javare Gowda, S.  
 \*433

516 Project Title : Long life packages for grapes.  
 Organisation : Indian Institute of Packaging, E-2, MIDC, Andheri (East), Bombay 400 093.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981-1982.  
 Sponsor(s) : Institute.  
 Investigator(s) : Narayanan, P.V. and others.  
 Description : The project aims to evolve a packaging system to provide long storage life for fresh grapes.  
 Report(s) : A report on 'long life package system for grapes'.  
 Papers Published : -

## Banana

517 Project Title : Varietal screening of bananas.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979/80-1982/83  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Surjeet Singh; Tripathi, V.K.  
 Description : Different banana varieties grown under agroclimatic conditions prevailing in Eastern Uttar Pradesh will be analysed for their physical, chemical and biochemical aspects with a view to select varieties suitable for local consumption and process-

ing. Efforts will also be made to find out suitable spraying treatments which will improve the development and storage life of fruits.

Report(s) : Interim.  
Papers Published :

518 Project Title : Drying of banana.  
Organisation : Rajendra Agricultural University; Bihar Agricultural College, Sabour, Bihar; Fruit Preservation Laboratory.  
Project Category : Applied and Exploratory.  
Cost : -  
Duration : June 1978-June 1981.  
Sponsor(s) : Univeristy.  
Investigator(s) : Singh, R.K. and others.  
\*435

519 Project Title : Correlation of delayed ripening with carbohydrate metabolism in irradiated banana.  
Organisation : Bhabha Atomic Research Centre, Bombay 470 085.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Centre.  
Investigator(s) : Nair, P.M.; Surendranathan, K.K.  
Description : Irradiation resulted in a shift in carbohydrate metabolism from glycolytic pathway to pentose phosphate pathway which in turn resulted in the activation of fructose-1,6-diphosphatase and fructose-6-phosphatase. The efficiency of operation of Kreb's cycle was assessed. Succinic acid dehydrogenase was most susceptible to gamma irradiation resulting in the decrease of its activity by about 40 to 50% by the third day and the activity continued to decrease even during further storage. Incorporation of  $^{14}\text{C}$ -acetate into keto acids like glyoxylate, alpha keto glutarate and oxaloacetate indicated that incorporation of radioactivity into glyoxalate was 2 fold higher. The percentage increase in incorporation of 2- $^{14}\text{C}$ -acetate into sugars like sucrose, glucose and fructose was 75, 50 and 88 respectively. Isocitrate lyase and malate synthetase activities could be measured in irradiated fruits. Both these enzymes showed enhancement after irradiation reaching a maximum level in 3 to 5 days. The operation of glyoxylate pathway and enhanced gluconeogenesis may hinder energy production essential for the ripening of the fruit.

Report(s) : -  
Papers Published : 1. Surendranathan, K.K. and Nair, P.M. Phytochemistry, 11; 1972; 119.  
2. Surendranathan, K.K. and Nair, P.M. Phytochemistry, 12, 1973; 241  
3. Surendranathan, K.K. and Nair, P.M. Phytochemistry, 15; 1976; 371  
4. Surendranathan, K.K. and Nair, P.M. Proc. Indian Acad. Sci. Section B (Exptl. Biol) 87; 1978; 119  
5. Surendranathan, K.K. and Nair, P.M. Plant Sci. Letters. 12; 1978; 169

520 Project Title : Studies on osmotic dehydration of banana.  
Organisation : Bhabha Atomic Research Centre, Bombay 470 085.  
Project Category : Applied (Fruit slicing machine, tanks, trays and related accessories required for processing were designed and fabricated at FIPLY)



- Cost : -  
Duration : -  
Sponsor(s) : Centre.  
Investigator(s) : Bongirwar, D.R.; Sreenivasan, A.  
Description : -  
Report(s) : -  
Papers Published : Bongirwar, D.R. and Sreenivasan, A. Studies on osmotic dehydration of banana . J. Food Sci. and Tech. 14(3); 1977; 104
- 521 Project Title : Chemistry and processing of bananas.  
Organisation : University of Bombay; Chemical Technology Department, Matunga Road, Bombay 400 019.  
Project Category : Fundamental and applied.  
Cost : Rs. 7,000/- per annum.  
Duration : -  
Sponsor(s) : University Grants Commission.  
Investigator(s) : Sangli, P.T.; Dubash, P.J.  
Description : Processing conditions for various products from banana varieties are being standardised and the effect of processing on their chemical constituents are being studied.  
Report(s) : -  
Papers Published : -
- 522 Project Title : Prolonged storage of banana.  
Organisation : Bhabha Atomic Research Centre, Bombay 470 085.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Centre.  
Investigator(s) : Nair, P.M.; Darak, B.G.  
Description : Fungal rot of banana accounts for large post-harvest losses. Several treatments were therefore tried to inhibit the disease. The most effective fungicide was found to be benomyl (methyl-1 (butyl carbonyl)2- benzimidazole carbonate) in 2% suspension. The bananas thus treated could be stored upto senescence stage for 16 days in the case of controls and 25 days in the case of irradiated ones (35 krad). Stalk rot was not detected during storage.  
Report(s) : -  
Papers Published : -
- 523 Project Title : Development of post-harvest procedures for shelf-life extension of bananas and mangoes.  
Organisation : Bhabha Atomic Research Centre, Bombay 470 085  
Project Category : Applied and basic.  
Cost : -  
Duration : 1970-continuing.  
Sponsor(s) : Centre.  
Investigator(s) : Thomas, P. and others.  
Description : The effect of gamma irradiation either alone or in conjunction with waxing, growth regulators, modified atmosphere, packing, etc. were studied with a view to increase the pre-climacteric as well as post-climacteric life of bananas and mangoes. Low dose irradiation (20-40 krad) was found to delay ripening the extent of which depended on fruit maturity, storage temperature etc. A dose of 25 krad was found sufficient to disinfect mangoes infested with egg and larval stages of the oriental fruit fly (Dacus dorsalis) and the melon fly (Dacus cucurbitae). Irradiation did not affect the chemical composition and quality

of fruits on ripening. The skin discolouration in fruits receiving doses higher than the optimal was correlated to enhanced polyphenoloxidase activity. In mangoes vitamin C levels in skin was found to be higher than in pulp at all stages of ripening. Storage of several banana varieties in closed polyethylene bags extend the preclimacteric life considerably at room temperature while Alphonso mangoes developed CO<sub>2</sub> injury and fruits failed to ripen normally on removal from the bag.

- Report(s) : -
- Papers Published : 1. Thomas, P. and Sreenivasan, A. Effect of gamma irradiation of post-harvest physiology of fruits. J. Sci. Ind. Res. 29; 1970; 414
2. Thomas, P. and Nair, P.M. Effect of gamma irradiation on polyphenol oxidase activity and its relation to skin browning in bananas. Phytochemistry. 10; 1971; 771
3. Thomas, P. and others. Effect of gamma-irradiation on the post-harvest physiology of five banana varieties grown in India. J. Food Sci. 36; 1971; 243
4. Thomas, P. and Janave, M.T. Polyphenoloxidase activity and browning of mango fruits induced by gamma irradiation. J. Food Sci. 38; 1973; 1149
5. Thomas, P. Effect of post-harvest temperature on quality, carotenoids and ascorbic acid content of Alphonso mangoes on ripening. J. Food Sci. 40; 1975; 704
6. Thomas, P. and Rahalkar, G.W. Disinfestation of fruit flies in mango by gamma irradiation. Current Science. 44; 1975; 775
7. Thomas, P. and Janave, M.T. Effect of gamma irradiation and storage temperature on carotenoids and ascorbic acid content of mangoes on ripening. J. Sci. Food Agric. 26; 1975; 1503
8. Thomas, P. and Padwal-Desai, S.R. Improvement of shelf-life and quality of mangoes by gamma irradiation. Indian Food Packer. Sept.Oct. 1976; 83
9. Thomas, P. and Oke, M.S. Distribution and content of vitamin C in mangoes during ripening. J. Food Technol. 15; 1980; 669

- 524 Project Title : Studies on banana flavour.
- Organisation : Bhabha Atomic Research Centre, Bombay.
- Project Category : Applied.
- Cost : -
- Duration : -
- Investigator(s) : Rao, B.Y.K.; Bandyopadhyay, C.
- Description : Aroma concentrates from the pulp of raw, half-ripe and fully ripe banana were isolated by high vacuum distillation and gas liquid chromatography. There was a progressive increase in the number of aroma components having estery notes during ripening. Pulp lipid composition of Harichal and Rajelli varieties during ripening indicated changes in fatty acid composition particularly relating to linoleic and linolenic acids and these changes were considered responsible for the subtle differences in aroma characteristics.
- Report(s) : -
- Papers Published : Rao, B.Y.K. and Bandyopadhyay, C. Changes in component fatty acids in pulp lipid of ripening banana. Acta Alimentaria. 7; 1978; 35



## Citrus

525 Project Title : Post harvest decay control of citrus fruits.  
 Organisation : Harcourt Butler Technological Institute, Kanpur 208 002  
 Project Category : Applied.  
 Cost : -  
 Duration : November 1973-.  
 Sponsor(s) : Institute.  
 Investigator(s) : Pandey, G.N.; Arora, R.  
 \*440

## Lime

526 Project Title : Studies on commercial utilisation of Rangpur limes  
 Organisation : Central Food Technological Research Institute, Mysore-570013;  
 Experiment Station, Hyderabad.  
 Project Category : Applied.  
 Cost : Rs. 1,33,000/-.  
 Duration : May 1980-December 1982.  
 Sponsor(s) : Institute.  
 Investigator(s) : Krishnamurthy, G.V.  
 Description : Efforts were made to produce lime juice cordial from Rangpur limes. The yield of juice from green and fully ripe fruits was 32% and 38% respectively. The Brix acidity of the juice was 10 and 7.6%, and 9.6 and 6.4% respectively. The cordial prepared from the clarified juice was acceptable at room temperature for 6 months. The recovery of oil from peel by steam distillation was 0.64%. The dried peels after recovery of oil yielded 21-22% pectin with 8-10% methoxyl content and 180-200 jelly grade. The bitterness of juice was identified by TLC as due to presence of limonin. Efforts to remove limonin by column chromatographic techniques were, however, not successful.  
 Report(s) : -  
 Papers Published : -

## Orange

527 Project Title : Industrial Utilisation of malta oranges (Citrus sinensis osbeck).  
 Organisation : Central Food Technological Research Institute  
 Experiment Station, Ludhiana 141 006  
 Project Category : Applied.  
 Cost : Rs. 85,780/-.  
 Duration : September 1978-August 1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Raina, B.L. and others.  
 Description : Juice made from Malta oranges (brix 10-11; acidity, 0.6-0.7%; vitamin D, 50.60 mg/100 g) yielded palatable beverage and squash. Stabilisation studies were also conducted. Similarly Kinnow oranges were studied for yield of juice (56%), peel (26%) and pomace (15%). The juice was analysed and found acceptable for preparing ready-to-serve beverage and squash. Fresh peel contained 0.75-1.0% essential oil. Pectin extraction studies were also conducted on peel and pomace.  
 Report(s) : -  
 Papers Published : 1. Pruthi, J.S. and others. Beverage development Kinnow orange and Malta orange. Presented at symposium on problems and prospects of food fermentation and beverage industry, Bangalore, May 1981.  
 \*441

## Mango

- 528 Project Title : Chemical composition and utilisation of wind fallen green mangoes for the manufacture of Amchur.  
 Organisation : Central Food Technological Research Institute, Mysore-570011-Experiment Station, Ludhiana.  
 Project Category : Fundamental.  
 Cost : Rs. 1,000/-.  
 Duration : May 1978-July 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Teotia, M.S.; Pruthi, J.S.  
 Description : The project has attempted physico-chemical analysis of commercial samples of amchur (powdered and sliced) manufactured in Punjab, Haryana and Delhi. Draft quality standards are formulated. Sundrying and dehydration of wind-fallen green mango slices for determination of the packaging requirements of amchur are conducted. Storage studies, effect of different containers like polythene bags, gunny bags, friction-top-tins, etc. on its storage, moisture pick-up, colour and mould infestation, etc. are also studied.  
 Report(s) : -  
 Papers Published : -
- 529 Project Title : Retention of carotenoids in the preparation of ripe mango powder.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981-continuing.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Mehta, G.L.; Tomar, M.C.  
 Description : Carotenoids, the precursors of vitamin A are relatively heat stable in the absence of oxygen but appreciable losses occur when heated in presence of oxygen. It was found that prolonged heating leads to complete destruction of carotenoids pointing out the need for methods favourable for carotenoid retention.  
 Report(s) : -  
 Papers Published : -
- 530 Project Title : Dehydration.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1978-continuing.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Mehta, G.L.; Tomar, M.C.  
 Description : At present, large quantities of raw mango slices are packed in brine in big containers were wooden barrels for local storage as well as for export. This study is concerned with dehydration of raw mango slices to save storage space and freight and to make their transport easy.  
 Report(s) : -  
 Papers Published : -



531 Project Title : Studies on low temperature storage and ripening behaviour of mangoes.

Organisation : Central Food Technological Research Institute, Mysore-570013; Fruit and Vegetable Technology Discipline.

Project Category : Fundamental and applied.

Cost : Rs. 44,400/-.

Duration : April 1978-March 1979.

Sponsor(s) : Institute.

Investigator(s) : Ramana, K.V.R. and others.

Description : Early and late harvest Badami mangoes (water sinkers) had 12 days and 16 days longer storage life at RH 85-90% and 55 ±1 F and 45 ±1 F respectively. Further ripening at room temperature of low temperature stored fruit resulted in total reduction in carotenoids which depended upon temperature and period of storage. With water floaters, however, no differences in sensory quality were evident between low temperature and room temperature ripening, though at latter temperature, TSS increased. Fruit stored at low temperature immediately after harvest showed no chilling injury during subsequent ripening. In contrast, fruit stored first at room temperature and then shifted to low temperature did show chilling injury. In low temperature stored fruit, greater spoilage occurred by Anthracnose and stem rot.

Report(s) : Final.

Papers Published : 1. Ramana, K.V.R. and others. Studies on low temperature storage and ripening behaviour of Alphonso mangoes (*Mangifera indica* L.). Presented at the Second Indian Convention of Food Scientists and Technologists, Mysore, February 1981)

\*448

532 Project Title : Role of polyphenols and pectin during fruit ripening and storage.

Organisation : Central Food Technological Research Institute, Mysore 570013; Fruit and Vegetable Technology Discipline.

Project Category : Fundamental and applied.

Cost : Rs. 61,200/-.

Duration : April 1977-March 1979.

Sponsor(s) : Institute.

Investigator(s) : Patwardhan, M.V. and others.

Description : A high correlation existed between the degree of browning and polyphenol content in ripe mango fruit and the rate of browning reduced with advance in ripening. In avocado peel, pulp, seed and seed coat, catechin and epicatechin were present; flavonol glycoside and caffeic acid were present in peel and pulp respectively. Four major leucoanthocyanidin spots were detected in peel, seed and, to a negligible extent, in pulp. Anthocyanins produced in peel during ripening were identified as cyanidin-3 galactoside and cyanidin 3-5 diglucoside p-coumarate. The polyphenols were also studied for the endogenous oxidation pattern and the browning substrates were catechin and epicatechin. Isoenzyme patterns of polyphenol oxidase and peroxidase in avocado peel and pulp were also followed during ripening.

Report(s) : Final.

Papers Published : 1. Prabha, T.N. and others. Anthocyanins of avocado. *J. Food Sci. Technol.* 17(5); 1980; 241

2. Prabha, T.N. and Patwardhan, M.V. Polyphenols of avocado and their endogenous oxidation. *J. Food Sci. Technol.* 17(5); 1980; 215

\*422

- 533 Project Title : Mango peel waste as a source of pectin.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Srirangarajan, A.N.; Shrikhande, A.J.  
 Description : Mango cannery waste consisting of peels contain 20-25% pectin of good quality. Efforts were made to extract pectin from both fresh and dehydrated peel. Both gave similar yield i.e. 15-20% on a dry weight basis. The process involves acid hydrolysis of protopectin by 0.01N HCl for approximately 4 hours, concentrating the mother liquor by 20-25 times by flash evaporation under vacuum precipitation of pectin by addition of ethanol, washing the precipitate twice with alcohol followed by drying at 40 C and pulverising to a fine powder.  
 Report(s) : -  
 Papers published : -
- 534 Project Title : Utilisation of mango waste.  
 Organisation : Andhra Pradesh Agricultural University; Fruit Research Station, Sangareddy 502 001.  
 Project Category : Exploratory.  
 Cost : -  
 Duration : 1977-continuing.  
 Sponsor(s) : ICAR  
 Investigator(s) : Rameshwar, A.  
 Description : Dropped mango fruits are mostly wasted and this project is concerned with their utilisation. Earlier, squash from dropped fruits was bottled using SO<sub>2</sub>. The jelly prepared from these fruits were of poor quality. Currently, dropped tender fruits are being preserved in brine containing different concentrations of citric acid.  
 Report(s) : -  
 Papers Published : 1. Rameshwar, A. and Kulkarni, V. Preservation of dropped mangoes. Papers, Mango Workers Meeting, Panaji, Goa, ICAR, 1979; 501
- \*462
- 535 Project Title : Waste utilisation.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-1983.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Kapur, K.L. and others.  
 Description : Fruit waste comprises about 30-40% of the total produce in the form of peel, stone and seed, and this project is concerned with the utilisation of mango waste which is a good source of protein, pectin, fat and starch. So far, 4 varieties of mangoes have been studied for the composition of waste.  
 Report(s) : -  
 Papers Published : -
- 536 Project Title : Dehydrated slices from ripe mango fruits.  
 Organisation : Andhra Pradesh Agricultural University; Fruit Research Station, Sangareddy 502 001  
 Project Category : Applied.



- Cost : -  
Duration : 1979-continuing.  
Sponsor(s) : ICAR  
Investigator(s) : Rameshwar, A.; Ismail, S.  
Description : Ripe mango slices are dehydrated by osmosis and oven drying to prepare a good dehydrated product which stores well at room temperature without canning or freezing. Slices of Banganapally variety of mango stored in polyethylene bags retained good flavour atleast for one year. The dried slices can be rehydrated by soaking in cold sugar syrup (24 B) for 18 hours. Attempts are now being made to bring down cost of production.
- Report(s) : -  
Papers Published : 1. Rameshwar, A. and others. Dehydrated mango slices from ripe mango fruits. Paper submitted for presentation at the All India Workshop of fruits, ICAR, 1981
- 537 Project Title : Physico-chemical analysis of fruits: Evaluation of mango germ plasm  
Organisation : Andhra Pradesh Agricultural University; Fruit Research Station, Sangareddy 502 001  
Project Category : Fundamental.  
Cost : -  
Duration : 1972-continuing.  
Sponsor(s) : ICAR  
Investigator(s) : Rameshwar, A.  
Description : Large number of mango cultivars collected at the station are being analysed for physicochemical aspects like pulp percentage, sugars, acidity, vitamins A and C and etc. So far 293 have been analysed with more to follow.
- Report(s) : -  
Papers Published : 1. Rameshwar, A. and others. Physicochemical analysis and keeping quality of mango cultivars at Sangareddy. Papers, Mango Workers Meeting, Panaji, Goa, ICAR, 1979.  
2. Rameshwar, A. and Sultan, M.A. Physicochemical analysis of mango cultivars at Sangareddy. Paper submitted for presentation at All India Workshop on Fruits, ICAR, 1981.  
\*461
- 538 Project Title : Survey for screening of juicy and table type mangoes of Marathwada region.  
Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani 431 402; Food Technology Discipline.  
Project Category : Applied.  
Cost : Rs. 10,000/-.  
Duration : May 1978-July 1982.  
Sponsor(s) : University.  
Investigator(s) : Kapse, B.M.; Khelkar, D.M.  
\*443
- 539 Project Title : Green mango aroma.  
Organisation : Bhabha Atomic Research Centre, Bombay.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Centre.  
Investigator(s) : Gholap, A.S.; Bandyopadhyaya, C.  
Description : Typical green mango aroma was extracted from the latex of freshly picked Alphonso and Batali mangoes by diethyl ether extraction followed by high vacuum distillation. The major components contributing 90% of the volatiles were identified

as cis-ocimene in Alphonso and  $\beta$ -mircene in Batai.

- Report(s) : -  
 Papers Published : 1. Gholap, A.S. and Bandyopadhyay, C. Characterisation of green aroma of raw magno (*Mangifera indica*). J. Sci. Food Agric. 28; 1977; 885
- 540 Project Title : Role of lipid in mango aroma.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Gholap, A.S.; Bandyopadhyay, C.  
 Description : The pulp lipid composition of the commercial varieties of mango, Alphonso and Totapuri, during ripening were studied. Ripening of Alphonso mango was found to be associated with marked increase in glyceride content with a rapid change in aroma and flavour, while in the case of Totapuri there were no appreciable changes. The ratio of palmitic to palmitoleic acid characteristics was higher in Totapuri mango. The fatty acid composition of pulp lipid of ripe mangoes, e.g. Alphonso, Langra, Totapuri, Neelum and Rajapuri was also studied. Relative content of palmitic and palmitoleic acid seemed to determine the flavour quality of the fruit.
- Report(s) : -  
 Papers published : 1. Gholap, A.S. and others. Studies on the triglyceride component of mango pulp. Ind. J. Technol. 9; 1971; 309  
 2. Bandyopadhyay, C. and Gholap, A.S. Changes in fatty acids in ripening mango pulp (Var. Alphonso). J. Agric. Food Chem. 21; 1973; 496  
 3. Bandyopadhyay, C. and Gholap, A.S. Relationship of aroma and flavour characteristics of mango (*Mangifera indica* L.) to fatty acid composition. J. Sci. Food Agric. 24; 1973; 1497  
 4. Gholap, A.S. and Bandyopadhyay. Contribution of lipid to aroma of ripening mango (*Mangifera Indica* L.). J. Ameri. Oil Chem. Soc. 52; 1975; 514  
 5. Gholap, A.S. and Bandyopadhyay, C.. Fatty acid composition as a quality index of ripe mango (*Mangifera indica*) pulp. Indian Food Packer. 30; 1976; 63
- 541 Project Title : Biogenesis of mango aroma.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre  
 Investigator(s) : Gholap, A.S.; Bandyopadhyay, C.  
 Description : Enzymatic regeneration of ripe mango aroma has been studied. Crude enzymes were isolated from the pulp of mangoes ripened at 10 $\pm$ 2 C by acetone precipitation. The filtrate containing the natural substrate was incubated with crude enzymes and the headspace gas was studied by gas liquid chromatography. Preliminary results showed that a reproducible Alphonso-like aroma could be obtained. Similarly, the incorporation of Alphonso crude enzymes into the enzyme deactivated ripe Totapuri mango pulp enhanced the fruity odour. Studies on biosynthesis of fatty acids in Alphonso slices by 2-C<sup>14</sup>-acetate and 1-C<sup>14</sup> palmitic acid incorporation in raw mango showed that incorporation into palmitic and palmitoleic acids



were higher as compared to incorporation into other fatty acids.

- Papers Published : -
- 542 Project Title : Role of lipid in mango aroma.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Gholap, A.S.; Bandyopadhyay, C.  
 Description : The pulp lipid composition of the commercial varieties of mango, Alphonso and Totapuri, during ripening were studied. Ripening of Alphonso mango was found to be associated with marked increase in glyceride content with a rapid change in aroma and flavour, while in the case of Totapuri there were no appreciable changes. The ratio of palmitic to palmitoleic acid previously ascertained as an index of mango aroma characteristics was higher in Totapuri mango.
- Report(s) : -
- Papers Published : -
- \*\*540
- 543 Project Title : Ripe mango aroma.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Gholap, A.S.; Bandyopadhyay, C.  
 Description : The aromatic principles obtained by vacuum distillation of three mango varieties (Alphonso, Langra and Totapuri) when ripe were studied by gas liquid chromatography. Despite some common odour notes. Certain distinctive features between them were observed. The data suggested that none of the individual components represented the true aroma of the variety. Besides the varietal differences, the aroma and flavour characteristics of the fruit also depended on the post-harvest storage temperature of ripening.
- Report(s) : -
- Papers Published : 1. Bandyopadhyay, C. and others. Studies on aroma of ripe mango: Isolation and concentration of the aroma (var. Alphonso). Indian J. Technol. 11; 1973; 275  
 2. Gholap, A.S. and Bandyopadhyay, C. Comparative assessment of aromatic principles of ripe Alphonso mango and Langra mango. J. Food Sci. Technol. 12; 1975; 262  
 3. Bandyopadhyay, C. and Gholap, A.S. Quantitation of flavour notes in mango varieties. Proceedings of the First Indian Conv. of Food Scientists and Technologists, AFST, Mysore, 4, 1978.
- 544 Project Title : Ripening and processing of mangoes at different stages of maturity.  
 Organisation : Indian Agricultural Research Institute, New Delhi 110 012; Horticulture and Fruit Technology Division; Fruit Preservation Section.  
 Project Category : Fundamental and applied.  
 Cost : -  
 Duration : May 1974-April 1980.

- Sponsor(s) : Institute.  
Investigator(s) : Roy, S.K.; Pandey, R.M.  
\*445
- 545 Project Title : Suitability of mango cultivars for preservation.  
Organisation : Andhra Pradesh Agricultural University; Fruit Research Station, Sangareddy 502 001.  
Project Category : Applied.  
Cost : -  
Duration : 1974-1982.  
Sponsor(s) : University.  
Investigator(s) : Rameshwar, A.; Kulkarni, V.  
\*446
- 546 Project Title : Flavour retention in processed mango during storage.  
Organisation : Bhabha Atomic Research Centre, Bombay.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Centre.  
Investigator(s) : Ramamurthy, M.S. and others.  
Description : The study of the aromatic principles, carotenoids, ascorbic acid, reducing sugars and total sugars of freeze dried and osmotically dried Alphonso mango flakes revealed that samples processed by either method were comparable during storage up to 6 months in sealed polyethylene bags at ambient temperature.  
Report(s) : -  
Papers Published : 1. Ramamurthy, M.S. and others, Osmotic dehydration of fruits: Possible alternative to freeze drying. Indian Food Packer. 32; 1978; 108  
2. Bandyopadhyay, C. Aroma and flavour retention in freeze dried foods. Proc. Workshop on Freeze Drying, IVS, Bombay. 1980; 66
- 547 Project Title : Freeze drying of mangoes.  
Organisation : Bhabha Atomic Research Centre, Bombay 470 085.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Centre.  
Investigator(s) : Bongirwar, D.R.  
Description : Mangoes were freeze dried in an accelerated freeze dryer. The product obtained was excellent in taste, colour and texture, with 75-80% rehydration being possible within 15 min. at room temperature. Quality assessment during storage indicated freezing in a contact plate freezer after dip treatment in EDTA gave a product of better quality.  
Report(s) : -  
Papers Published : -
- 548 Project Title : Effect of freezing methods on the quality of freeze dried alphonso mangoes.  
Organisation : Bhabha Atomic Research Centre, Bombay 470 085.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Centre.  
Investigator(s) : Ramamurthy, M.S.; Bongirwar, D.R.  
Description : -



- Report(s) : -  
 Papers Published : 1. Ramamurthy, M.S. and Bongirwar, D.R. Effect of freezing methods on the quality of freeze dried Alphonso mangoes. J. Food Sci. and Techn. 16(6); 1979; 234
- 549 Project Title : Trials on mango pulp and stored juice canning eliminating retort steps.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Fruit and Vegetable Technology Discipline and Experiment Stations at Mangalore, Hyderabad, Ludhiana and Lucknow.  
 Project Category : Applied.  
 Cost : Rs. 25,000/-  
 Duration : May 1981-February 1982.  
 Sponsor(s) : Institute.  
 Investigator(s) : Patwardhan, M.V. and others.  
 Description : The storage behaviour of mango pulp in unretorted cans and hot water treatment of mangoes were studied. The contents of six unprocessed and six processed cans from a mangoes product canning unit were analysed for Brix, pH, acidity and organoleptic evaluation and swelling of cans and microbiological spoilage. Data were collected at initial, first week, 1 month, 6 months and 9 months storage at ambient temperature and 37 C and analysed.  
 Report(s) : -  
 Papers Published : -
- 550 Project Title : Bulk packaging of mango pulp.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Shrikhande, A. J. and others.  
 Description : Mango pulp can be packed in 6 kg capacity high density polyethylene containers which will help reducing the cost of packaging by 30 to 40% and eliminating the use of sulphur dioxide which is toxic. The product thus packed rated well in sensory score and stored well for 6 months under ambient conditions. A scale up study of producing the pulp for packaging as above has also been carried out. The process involves pulping several thousand mangoes in a pulper followed by pasteurization at 90 C in a continuous heat exchanger. The pulper and the heat exchanger have also been designed.  
 Report(s) : -  
 Papers Published : 1. Shrikhande, A.J. and others. A thermal process for bulk packaging of mango pulp. Indian Food Packer. 30(5); 1976; 65
- 551 Project Title : Heat exchanger for mango pulp.  
 Organisation : Bhabha Atomic Research Centre, Bombay 470 085.  
 Project Category : Applied. (Unit designed and fabricated and used at FIPLY)  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Bongirwar, D.R.  
 Description : -  
 Report(s) : -  
 Papers Published : -  
 \*\*550

- 552 Project Title : Mango pulper.  
 Organisation : Bhabha Atomic Research Centre, Bombay 470 085.  
 Project Category : Applied (Unit designed fabricated and used at FIPLY).  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Bongirwar, D.R.  
 Description :  
 Report(s) :  
 Papers Published : -
- 553 Project Title : Suitability of commercial mango cultivars for long distance transport.  
 Organisation : Andhra Pradesh Agricultural University; Fruit Research Station, Sangareddy 502 001.  
 Project Category : Applied and exploratory.  
 Cost : -  
 Duration : 1977-1980.  
 Sponsor(s) : University.  
 Investigator(s) : Rameshwar, A.; Kulkarni, V.  
 \*449 :
- 554 Project Title : Study of the changes in quality parameters in mango during processing and storage, and screening of suitable varieties for processing of mango juice.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.-226 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1975-1980.  
 Sponsor(s) : Government of Uttar Pradesh, Horticulture and Fruit Utilisation Directorate, Lucknow.  
 Investigator(s) : Kapur, K.L.  
 \*450
- 555 Project Title : Studies on the suitability of mango cultivars for preservation and canning.  
 Organisation : Andhra Pradesh Agricultural University; Fruit Research Station, Sangareddy 502 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1971-1985.  
 Sponsor(s) : University.  
 Investigator(s) : Rameshwar, A.; Kulkarni, V.  
 \*460
- 556 Project Title : Survey of mango stone weevil infestation in mango varieties grown in Gujarat State.  
 Organisation : Gujarat Agricultural University; N.M. College of Agriculture, Navasari, Gujarat.  
 Project Category : Applied and Survey.  
 Cost : Rs. 50,000/-.  
 Duration : 1974-1979..  
 Sponsor(s) : University.  
 Investigator(s) : Shah, A.H.; Patel, G.M.  
 \*453



- 557 Project Title : Studies on mango kernel fat.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Bandyopadhyay, C.; Gholap, A.S.  
 Description : Physico-chemical characteristics of mango kernel fat were determined. The fatty acid composition of kernel fat was determined by gas liquid chromatography. Stearic acid and oleic acid were the major components of fatty acids. The fat had the typical characteristics of vegetable butter.  
 Report(s) : -  
 Papers Published : 1. Bandyopadhyay, C. and Gholap, A.S. On the chemical composition of mango kernel fat (*Mangifera indica*. L). Current Sci. 48; 1979; 935
- 558 Project Title : Amawat.  
 Organisation : Horticultural Experiment and Training Centre, Basti 272 001  
 Project Category : Fundamental.  
 Cost : -  
 Duration : 1978-1980.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s), : Awasthi, R.K.; Phool Badan Ram.  
 \*463

### Jackfruit

- 559 Project Title : Preservation of jack fruit as vegetable.  
 Organisation : Rajendra Agricultural University; Bihar Agricultural College, Sabour; Bihar; Fruit Preservation Laboratory.  
 Project Category : Applied.  
 Cost : -  
 Duration : May 1977-June 1980.  
 Sponsor(s) : University.  
 Investigator(s) : Singh, R.K. and others.  
 \*465
- 560 Project Title : Jack fruit dehydration.  
 Organisation : Horticultural Experiment and Training Centre, Basti 272 001,  
 Project Category : Fundamental.  
 Cost : -  
 Duration : 1978-1980.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Awasthi, R.K.; Phool Badan Ram.  
 \*466

### Pome

- 561 Project Title : Study of the post-harvest physiology of minor temperate pome and stone fruits during ripening and subsequent storage at room temperature.  
 Organisation : Central Food Technological Research Institute, Experiment Station, Ludhiana 141 006  
 Project Category : Applied.  
 Cost : Rs. 2,27,600/-.  
 Duration : May 1978-December 1981.  
 Sponsor(s) : Institute.  
 Investigator(s) : Rodriguez, R.

Description : Wilham and Bartleh pears were harvested at 3-4 stages of maturity ripened in the laboratory and stored at room temperature and at 2-5 C. The fruit continued to grow but slowly indicating the advantage of retaining the fruit on the tree till full maturation. Browning as well as starch-iodine reaction did not give indication of maturity in laboratory matured fruit. There was slight increase in TSS and sugar levels with progressing maturity and fall in the insoluble fraction.

Report(s) : -

Papers Published : 1. Pruthi, J.S. and others. Cherries. I. Agrihorticulture and chemical aspects. Indian Food Packer. 34(5); 1980; 33  
2. Pruthi, J.S. and others. Cherries. II. Technological aspects. Indian Food Packer. 36(4); 1982; 36

\*467

### Pomegranate

562 Project Title : Utilisation of wild and cultivated pomegranates for the manufacture of anardana.  
Organisation : Central Food Technological Research Institute, Experiment Station, Ludhiana.  
Project Category : Applied.  
Cost : Rs. 4,500/-.  
Duration : September 1979-December 1980.  
Sponsor(s) : Institute.  
Investigator(s) : Saxena, A.K.; Pruthi, J.S.  
Description : 21 samples of Anardana procured from different regions of Jammu and Kashmir, Himachal Pradesh and Ludhiana were analysed for their physico-chemical characteristics. Moisture ranged from 7.40 to 12.20%. Acidity was the lowest in Ludhiana sample and the highest in J&K sample. Reducing sugars ranged from 9.26 (J&K) to 16.80 in (HP) samples. Because of high acidity, total sugars were almost equal to reducing sugars. Non-reducing sugars ranged from only 0.07 to 1.26%. Ether extract ranged from 0.25 to 0.40%. Protein ranged from 5.35 to 6.25%. Equilibrium relative humidity (ERH) studies were conducted using two samples of different moisture and found that no change in colour and texture was noticed upto 60% RH.  
Report(s) : -  
Papers Published : -

### Apple

563 Project Title : Post harvest physiology of apples.  
Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
Project Category : Applied.  
Cost : -  
Duration : 1981/82-1982/83  
Sponsor(s) : Government of Uttar Pradesh.  
Investigator(s) : Ram, H.B. and others.  
Description : Different varieties of apple procured from Government Garden, Chaubattia, Raniket, are being treated with wax emulsion and studied for their storage behaviour. Two different types of emulsions in waxol O and waxol W have been used with reasonable success. Trials will be conducted to firmly establish the efficacy of these emulsions in extending the shelf-life of the fruits.  
Report(s) : -  
Papers Published : -



564 Project Title : Storage studies on apple aroma.  
 Organisation : Cadbury India Limited, Cadbury House, B. Desai Road, Bombay 400 026.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 40,000/-.  
 Duration : January 1981-June 1982.  
 Sponsor(s) : Company.  
 Investigator(s) : Shenoy, R.D. and others.  
 Description : The characteristics of apple aroma are being investigated in order to extend its shelflife. Studies on storage and packing conditions have also been conducted. The shelflife studies are currently in progress.  
 Report(s) : -  
 Papers Published : -

#### Cashew apple

565 Project Title : Post-harvest handling and processing of cashew apple.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Fruit and Vegetable Technology Division.  
 Project Category : Applied.  
 Cost : Rs. 39,400/-.  
 Duration : January 1979-June 1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Patwardhan, M.V. and others.  
 Description : Of the several pretreatments tried to prevent spoilage during transport, steeping of fruit for five minutes in sodium metabisulphite solution was found very effective. Proper cushioning of baskets helped in further reducing spoilage. The spoilage fungi were isolated and identified as *Aspergillus niger*, *Penicillium*, *Rhizopus* and *Actinomucor*. Their sensitivity to different SO<sub>2</sub> concentrations were tested. Conditions were worked out for maximum extraction of juice. Of several treatments tried for the removal of astringent and acid principles, gelatin and hyflosupercel treatments were effective. Carbonated and non-carbonated pasteurised RTS beverages were prepared from clarified juice after treatment and subjected to taste panel; pasteurised juice was preferred. Blends of cashew apple juice with other fruit juices were also tried. Cashew with lime, cashew with pineapple and cashew with grape juices were found acceptable in that order.  
 Report(s) : -  
 Papers Published : 1. Nanjundaswamy, A.M. and others. Utilisation of cashew apple for the development of processed products. Presented at cashew apple symposium, Cochin, March 1979.

#### Papaya

566 Project Title : Post-harvest physiology of papaya fruits.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981/82-1982/83  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Ram, H.B. and others.  
 Description : Fully mature papaya fruits procured from Government Garden, Alambagh, Lucknow and subjected to different treatments were studied for their ripening behaviour and keeping quality. The

objective is to develop an artificial method of ripening which will facilitate proper colour development.

Report(s) :  
Papers Published :

567 Project Title : Studies on processing of papaya pulp.  
Organisation : Marathawada Agricultural University; College of Agricultural Technology, Parbhani 431 402; Fruit and Vegetable Technology Discipline.  
Project Category : Applied.  
Cost : Rs. 52,000/-.  
Duration : 1978-1982.  
Sponsor(s) : University.  
Investigator(s) : Khedkar, D.M.; Kapse, B.M.  
\*470

#### Guava

568 Project Title : Effect of processing on vitamin C in the preparation of guava powder.  
Organisation : Government Fruit Preservation and Canning Institute, 18-B Ashok Marg, Lucknow.  
Project Category : Applied.  
Cost : -  
Duration : 1981-continuing.  
Sponsor(s) : Government of Uttar Pradesh.  
Investigator(s) : Mehta, G.L.; Tomar, M.C.  
Description : The study reveals that ascorbic acid, being heat sensitive and water soluble, is easily lost during processing. It is affected even during storage.  
Report(s) : -  
Paper's Published : -

569 Project Title : Canning trial on guava cultivars.  
Organisation : Horticultural Experiment and Training Centre, Basti 272 001.  
Project Category : Fundamental.  
Cost : -  
Duration : 1978-1980.  
Sponsor(s) : Government of Uttar Pradesh.  
Investigator(s) : Awasthi, R.K.; Phool Badan Ram.  
\*471

#### Bael fruit

570 Project Title : Changes during ripening, storage behaviour and processing quality of bael fruit (Aegle marmelos Corr).  
Organisation : Indian Agricultural Research Institute, New Delhi 110 012; Horticulture and Fruit Technology Division; Fruit Preservation Section.  
Project Category : Fundamental, applied and survey.  
Cost : -  
Duration : April 1972-March 1980.  
Sponsor(s) : Institute.  
Investigator(s) : Roy, S.K.; Singh, R.N.  
\*472

#### Ber

571 Project Title : Varietal screening of ber.  
Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
Project Category : Applied.



Cost : -  
 Duration : 1981/82-1982/83.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Surjeet Singh; Tripathi, V.K.  
 Description : Different varieties of ber grown in Eastern Uttar Pradesh, will be analysed for their physico chemical and biochemical characteristics with a view to select the varieties suitable for local consumption and processing.  
 Report(s) : Interim.  
 Papers Published : -

#### Sugar, Confectionery and Preserves

- 572 Project Title : Modification of cane wax.  
 Organisation : National Sugar Institute, Kanpur, Uttar Pradesh.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1975-1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Bose, S.; Gupta, K.C.  
 \*473
- 573 Project Title : Phosflotation process for sugar melt clarification.  
 Organisation : Walchandnagar Industries Ltd., Walchandnagar 413 114.  
 Project Category : Applied.  
 Cost : Rs. 4,00,000/-.  
 Duration : 1976-1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Chatterjee, A.C. and others.  
 \*474
- 574 Project Title : Toxicity of irradiated sugar solutions to microorganisms.  
 Organisation : Bhabha Atomic Research Centre, Trombay, Bombay 400 085; Biochemistry and Food Technology Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Subba rao, V.; Aiyar, AS.  
 \*477
- 575 Project Title : Juice analysis programme: Saccharum species, seedlings, hybrid clones, etc.  
 Organisation : Sugar Cane Breeding Institute, Coimbatore 641 007; Agricultural Chemistry and Soil Science Department.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1974-.  
 Sponsor(s) : Institute.  
 Investigator(s) : Thangavelu, S. and others.  
 \*478
- 576 Project Title : Demineralisation of cane juices by using ion exchange resins.  
 Organisation : National Sugar Institute, Kanpur, Uttar Pradesh.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1976-1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Ramaiah, N.A.; Srivastava, S.K.  
 \*479

- 577 Project Title : Preservation of cane sugar juice as a concentrate.  
 Organisation : University of Bombay, Department of Chemical Technology, Matunga Road, Bombay 400 019.  
 Project Category : Applied.  
 Cost : Rs. 7,000/- per annum  
 Duration : Two years.  
 Sponsor(s) : University Grants Commission, New Delhi.  
 Investigator(s) : Mungad, P.R.; Kulkarni, P.R.  
 Description : Conditions for obtaining an acceptable sugar cane juice concentrate to be useful as a sweetening agent in food industry are being standardised.  
 Report(s) : -  
 Papers Published: : -
- 578 Project Title : Studies on jaggery: Jaggery quality of certain popular and promising sugar canes.  
 Organisation : Sugar cane Breeding Institute, Coimbatore 641 007; Agricultural Chemistry and Soil Science Department.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977-..  
 Sponsor(s) : Institute.  
 Investigator(s) : Thangavelu, S.; Chiranjivi Rao, K.  
 \*481
- 579 Project Title : Production of high fructose sweet syrup.  
 Organisation : National Sugar Institute, Kanpur, Uttar Pradesh.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1976-1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Bose, S.; Gupta, K.C.  
 \*482
- 580 Project Title : Studies on production of fructose syrup.  
 Organisation : Britannia Industries Ltd; Research and Development Division, Plot 112, Street 13, Marol MIDC, Andheri East, Bombay 400 093.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1982-..  
 Sponsor(s) : Company.  
 Investigator(s) : Menon, C.P.S.; Krishna, B.M.  
 Description : In view of the recent high cost of sugar and also since the company's consumption of sugar is very large, an economically viable process for manufacture of fructose syrup is being developed. Laboratory scale studies are currently in progress to finalise reaction conditions.  
 Report(s) : -  
 Papers Published : -
- 581 Project Title : Studies on isolation, large scale extraction and immobilization of glucoamylase on inert carriers for the conversion of starch to glucose.  
 Organisation : Indian Institute of Science, Bangalore 560 012; Chemical Engineering Department.  
 Project Category : Fundamental, applied and exploratory.  
 Cost : Rs. 5,000/-..  
 Duration : August 1976-December 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Subba Rao, P.V. and others.  
 \*484



582 Project Title : New Product development with new bites and textures.  
 Organisation : Britannia Biscuit Company Limited, 'Nirmal', 20th Floor,  
 Nariman Point, Bombay 400 021.  
 Project Category : Applied.  
 Cost : -  
 Duration : March 1978-February 1979.  
 Sponsor(s) : Company.  
 Investigator(s) : Krishnaswamy, S.V.; Bedekar, D.B.  
 \*490

583 Project Title : Studies on jaggery/sugar based indigenous confectionery -  
 standardisation, packaging and storage studies.  
 Organisation : Central Food Technological Research Institute, Experiment  
 Station, Lucknow.  
 Project Category : Applied/developmental.  
 Cost : Rs. 24,610/-  
 Duration : October 1978-March 1981.  
 Sponsor(s) : CSIR  
 Investigator(s) : Chakraborty, S. and others.  
 Description : Processes for preparing traditional jaggery and sugar based  
 sweets (Gajak and Rewri) were standardised. The products  
 were also studied for physico-chemical and organoleptic  
 characteristics. Shelf life and packaging studies with six  
 types of flexible packaging materials were conducted. It was  
 found paper/foil/poly laminate, LDPE-100 g packed in 18 litre  
 friction top can, HDPE-25 g and LDPE-400 g were suitable to  
 give six month shelf life to the product.  
 Report(s) : Final.  
 Papers Published : -  
 \*485

#### Bakery products

584 Project Title : Studies on improving the quality of bakery products containing  
 soya and tubers.  
 Organisation : Central Food Technological Research Institute, Mysore 570 013;  
 Flour Milling and Baking Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 12,900/-.  
 Duration : January 1979-June 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Shurpalekar, S.R.; Chandrashekara, S.  
 Description : The project has worked out suitable process know-how for maxi-  
 mum incorporation of soya flour in bakery products and to deve-  
 lop a relatively low cost recipe which gives acceptable grade  
 bakery product. The relative advantages of using tuber pulps  
 in place of tuber flours with regard to quality profiles and  
 relative cost of the finished product is also studied. Suitable  
 methods for the use of blends of tuber flours to be incorpora-  
 ted in the bakery products and the effect of the same on the  
 quality parameters are also worked out. Protein rich bread us-  
 ing soyprotein and tubers by the mechanical dough development  
 method is also developed.  
 Report(s) : -  
 Papers Published : -

- 585 Project Title : Vitamin assays in bakery goods and raw materials.  
 Organisation : Britannia Industries Ltd., Research and Development Division,  
 Plot 112, Street 13, Marol MIDC, Andheri East, Bombay 400 093.  
 Project Category : Applied.  
 Cost : -  
 Duration : Project closed.  
 Sponsor(s) : Company.  
 Investigator(s) : Narang, N.J.; Lakdawala, D.R.  
 Description : Suitable methods have been developed for vitamins A, B<sub>1</sub>, B<sub>2</sub>  
 Nicotinamide and vitamin D and their stability in bakery pro-  
 ducts have been studied.  
 Report(s) : Report for company circulation only.  
 Papers Published : -  
 \*488
- 586 Project Title : Emulsifiers for bakery products.  
 Organisation : Britannia Industries Ltd., Research and Development Division,  
 Plot.112, Street 13, Marol MIDC, Andheri East, Bombay 400 093.  
 Project Category : Applied.  
 Cost : -  
 Duration : Not being pursued owing to other priorities.  
 Sponsor(s) : Company.  
 Investigator(s) : Narang, N.T.; Naik, S.V.  
 \*770
- 587 Project Title : Development of premixes for bakery and confectionery.  
 Organisation : Food Craft Institute, Shivaji Nagar, Pune 411 005.  
 Project Category : Applied.  
 Cost : Rs. 1,500/-.  
 Duration : 1982-1984.  
 Sponsor(s) : Institute.  
 Investigator(s) : Gangolli, V.A.; Pusegaonkar, A.K.  
 Description : Development of premixes for bakery and confectionery to suit  
 Indian conditions and tastes is being attempted.  
 Report(s) : -  
 Papers Published : -
- 588 Project Title : Studies on the characterisation and utilisation of products  
 obtained from traditional milling process.  
 Organisation : Central Food Technological Research Institute, Mysore 570 013;  
 Flour Milling and Baking Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,40,700/-.  
 Duration : July 1980-June 1982.  
 Sponsor(s) : Institute.  
 Investigator(s) : Shurpalekar, S.R. and others.  
 Description : A simple milling process was developed to obtain different  
 milled products satisfying PFA regulations - flour for bread  
 and atta for chapati. Trials were conducted with this improved  
 process to mill wheats suitable for bread and biscuit making  
 and determine the range of yields of bakery flour without  
 affecting the chapati making quality of the remaining atta. An  
 improved sifter was also developed to get better sieving effi-  
 ciency with huller and chakki. Products made from the flour  
 (bread and biscuit) and atta (chapati) were evaluated. The  
 results obtained in this project has evinced interest in  
 Defence authorities particularly in regard to atta.  
 Report(s) : -  
 Papers Published : -



- 589 Project Title : Incorporation of millet flours in bakery products.  
 Organisation : Tamil Nadu Agricultural University, Coimbatore 641 003; Department of Food Technology.  
 Project Category : Applied.  
 Cost : Rs. 4,000/-.  
 Duration : March 1981-September 1982.  
 Sponsor(s) : University.  
 Investigator(s) : Neelakantan, S.; Saraswathi Eswaran.  
 Description : The project is concerned with enhancing the utilisation of millet flours in bakery products at acceptable levels. These low-cost supplementary snacks with longer storage life will be welcome in day-to-day life and will provide variety and value added products from these millets. The millets being studied are ragi, bajra and jowar.  
 Report(s) : -  
 Papers Published : -
- 590 Project Title : Flavour developments for bakery foods.  
 Organisation : Britannia Industries Ltd; Research and Development Division, Plot 112, Street 13, Marol MIDC, Andheri East, Bombay 400 093.  
 Project Category : Applied.  
 Cost : -  
 Duration : Closed.  
 Sponsor(s) : Company.  
 Investigator(s) : Krishnaswamy, S.V. and others.  
 Description : As a result of the project work, two new products have been introduced.  
 Report(s) : Report for company circulation only.  
 Papers Published : -  
 \*772
- 591 Project Title : Comparative studies on the suitability of different breadmaking methods for Indian flours.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Flour Milling and Baking Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 3.15 lakhs.  
 Duration : September 1982-September 1985.  
 Sponsor(s) : Institute.  
 Investigator(s) : Shurpalekar, S.R. and others.  
 Description : Many of the Indian milled flours had excessively high  $\alpha$ -amylase activity. To overcome this studies were undertaken i) by varying the levels of ingredients, (ii) modifying the processing conditions and (iii) using suitable additives. The salt-level was increased from 1.0 to 2.0% to improve both dough characteristics and crumb characteristics of bread. The dough handling properties were also considerably improved by using any one of the following additives: 1) glyceryl monostearate (0.5%), ii) enzyme active soya flour (0.5%) (iii) skimmed milk powder (3.0%), (iv) disodium hydrogen phosphate (50/m eq/g flour).  
 Report(s) : -  
 Papers Published : -
- 592 Project Title : Incorporation of bajra, hybrid jowar and ragi in bread.  
 Organisation : Food Craft Institute, Shivaji Nagar, Pune 411 005.  
 Project Category : Applied.  
 Cost : Rs. 500/-.  
 Duration : 1981-1982.  
 Sponsor(s) : Institute.

- Investigator(s) : Gangolli, V.A. and others.  
 Description : The project aims to make hybrid jowar and bajra more acceptable in bread.  
 Report(s) : —  
 Papers Published : —
- 593 Project Title : Studies on Indian traditional foods - roti and similar products.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Flour Milling and Baking Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,96,500/-.  
 Duration : April 1977-November 1980.  
 Sponsor(s) : CSIR  
 Investigator(s) : Shurpalekar, S.R. and others.  
 Description : Samples of soft and hard wheat were studied for chapati making quality. Chapati from hard wheat had better bursting strength, tearing resistance and puncture test values. Both methods of smearing the press with oil or dusting of dough with flour improved spreadability which in turn was influenced by extraction rate of flour as well as amount and duration of application of force. A simple method based on the principle of extrusion was developed to assess the consistency of the chapati dough. The optimum consistency expressed as time of extrusion was 60-62 seconds. A relationship based on farinograph water absorption was derived to estimate the water requirement for an optimal consistency of dough. In extensograph studies, it was shown that both high extensibility and resistance to extension were desirable in chapati dough. For a given mix, the period of mixing significantly influenced dough extensibility. Resting the dough for 1-2 hours increased strength and rolling properties. Addition of salt (0.5%) increased resistance to extension. Effect of milling in different chakkies on the chemical, rheological and chapati making qualities was studied and there were wide variations between chakkies. Sensory parameters of chapati was affected by recipe, wheat variety, milling and processing conditions were also investigated. Warner-Bratzler shear force value, expressed as  $\text{kg.cm}^{-2}$  could be used to predict the impact attribute texture of chapaties or roties.  
 Report(s) : —  
 Papers Published : —
- 594 Project Title : Studies on chapati with improved shelf life.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Flour Milling and Baking Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 48,200/-.  
 Duration : April 1981-March 1982.  
 Sponsor(s) : Institu  
 Investigator(s) : Haridas Rao, P. and others.  
 Description : Pliability and storage of chapati was not affected when stored in closed plastic container or polythene bag (150 g); wrapping chapaties in wax coated paper rendered them slightly hard and less pliable. Staling during storage was not related to loss of moisture but related to changes in starch characteristics reflected in its susceptibility to enzyme action and decreased water imbibing characteristics. The slight off-flavour observed 2-3 days after storage in plastic containers or polyethene bags could be reduced by increasing the baking time or wrapping in wax paper. Incorporation of fat or salt to dough delayed the onset of mould growth during storage. A simple instrument for



the measurement of pliability of chapati was designed. The instruments quantifies the texture and keeping quality of the chapati during storage.

Report(s) : -  
Annual Reports(s) : -

595 Project Title : Studies on Indian traditional foods; Nan like products.  
Organisation : Central Food Technological Research Institute, Mysore-570013; Flour Milling and Baking Technology Discipline.  
Project Category : Applied.  
Cost : Rs. 1,69,500/-.  
Duration : May 1977-December 1980.  
Sponsor(s) : CSIR  
Investigator(s) : Abdul Rahim and others.  
Description : Instrumental methods for evaluation of Nan dough and Nan were standardised. Experiments showed that polished wheat flours could be used to prepare Nan without any adverse effect on its quality. Conditions for keeping the Nan hot for about 4 hours were worked out.

Report(s) : Final.  
Papers Published : 1. Rahim, A. and others. Quality requirements of wheat flour for the preparation of Nan - an Indian traditional food. Presented at Ahara 82: International Food Conference, Bangalor, May 1982.

596 Project Title : Recipe development of eggless cake.  
Organisation : Food Crafts Institute, Shivaji Nagar, Pune 411 005  
Project Category : Applied.  
Cost : Rs.500/-.  
Duration : 1981-1982.  
Sponsor(s) : Institute.  
Investigator(s) : Gangolli, V.A.; Pusegaonkar, A.K.  
Description : The project intends developing recipes of cake containing no egg which could be consumed by vegetarians and also by heart patients who are advised to consume less cholesterol.

Report(s) : -  
Papers Published : -

597 Project Title : Recipe development of low cost biscuits.  
Organisation : Food Craft Institute, Shivaji Nagar, Pune 411 005.  
Project Category : Applied.  
Cost : Rs. 1,000/-.  
Duration : 1981-1982.  
Sponsor(s) : Institute.  
Investigator(s) : Gangolli, V.A. and others.  
Description : Hygienic, good quality and acceptable biscuits having longer shelf-life are being developed.

Report(s) : -  
Papers Published : -

#### Sweet meat and savoury products

598 Project Title : Milk based sweets (Indian).  
Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani 431 402; Department of Dairy Technology.  
Project Category : Applied.  
Cost : Rs. 10,000/-.  
Duration : July 1981-February 1983.  
Sponsor(s) : University and Government of Maharashtra.

- Investigator(s) : Mathi, S.D.  
 Description : There is a wide variety of milk based sweets popular among Indian public. This project is concerned with the chemical composition of various sweets and standardising the procedures of their preparation.  
 Report(s) : -  
 Papers Published : -
- 599 Project Title : Canning of sweet meat made out of milk.  
 Organisation : Food Crafts Institute, Shivaji Nagar, Pune 411 005.  
 Project Category : Applied.  
 Cost : Rs. 2,000/-.  
 Duration : 1982-1983.  
 Sponsor(s) : Institute.  
 Investigator(s) : Gangolli, V.A. and others.  
 Description : Investigations are being carried out for developing different canning methods for sweets made out of milk.  
 Reports(s) : -  
 Papers Published : -
- 600 Project Title : Studies to find out appropriate preservation and packaging techniques for Sohan halwa, Sohan papri, Burfi and fried dhal  
 Organisation : Central Food Technological Research Institute, Mysore-570013.  
 Project Category : Applied.  
 Cost : Rs. 2,05,180/-.  
 Duration : December 1976-February 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Amla, B.L. and others.  
 Description : Extensive studies were carried out on the above products having export potential in order to improve their physico-chemical, organoleptic and storage properties. Suitable packaging suitable for export was also developed.  
 Report(s) : Final.  
 Papers Published : 1. Bhat, K.K. and others. Studies on packaging and storage of fried mung dhal (*Phaseolus aureus*). J. Food Sci. Technol. 19; 1982; 197  
 2. Lakshmivenkatesh, K.V. and others. Analysis of Sohan halwa and Sohan papri. Indian Food Pack. 36(5); 1982; 77.  
 3. Lakshmivenkatesh, K.V. and others. Studies on the packaging and storage of Indian sweet meat: Sohan halwa and Sohan papri. Presented at Ahara-82: International Food Conference, Bangalore, May 1982.
- \*495
- 601 Project Title : Standardization and microbial study of Maharashtraian sweet meats.  
 Organisation : Food Crafts Institute, Shivaji Nagar, Pune 411 005.  
 Project Category : Applied.  
 Cost : Rs. 2,500/-.  
 Duration : 1982-1983.  
 Sponsor(s) : Institute.  
 Investigator(s) : Gangolli, V.A.; Pusegaonkar, A.K.  
 Description : The project aims to standardize the composition, quality and processing techniques of Maharashtraian sweet meats.  
 Report(s) : -  
 Papers Published : -
- 602 Project Title : Studies on storage quality of pedha.  
 Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani 431 402; Department of Dairy Technology.



Project Category : Applied.  
 Cost : Rs. 5,000/-  
 Duration : January 1979-November 1981.  
 Sponsor(s) : University and Government of Maharashtra.  
 Investigator(s) : Rathi, S.D.; Joglekar, N.V.  
 Description : Pedha is a popular khoa-based sweet and so was evaluated to assess its storage behaviour at accelerated temperature and determine the possible causes of its deterioration. It was noted that samples exhibited good storage quality characteristics up to 5th day of storage at  $37 \pm 1$  C. The main cause of deterioration was found to be the hardening in texture. The increase in free fatty acid content and peroxide values in deteriorating pedha suggested that the hydrolytic changes and hydroperoxide formation contributed to rancidity development. The need for proper packaging to prevent deterioration was noted and packaging studies with different packaging materials were carried out.

Report(s) : -

Papers Published :

603 Project Title : Studies on moisture sorption isotherm and water activity of pedha.  
 Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani 431 402; Department of Dairy Technology.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 5,000/-.  
 Duration : January 1979-December 1981.  
 Sponsor(s) : University and Government of Maharashtra.  
 Investigator(s) : Joglekar, N.V.; Rathi, S.D.  
 Description : The objectives of the project are: a) to compare the sorption behaviour of market pedha and pedha prepared under standardised conditions; and (b) to determine the critical moisture contents of market pedha and standard pedha from their respective sorption isotherms. The ERH of market and standard pedhas were 45.5% and 51% respectively and the critical moisture contents were 12.0% and 11.3% (on dry basis) respectively. It was found that storage in 300 gauge HDPE could be ideal to protect pedhas from excessive sorption or desorption of moisture. Package studies were also carried out.

Report(s) : -

Papers Published : -

604 Project Title : Studies on the various factors affecting the composition and quality of gulab jamun  
 Organisation : Punjabrao Krishi Vidyapeeth, Akola 444 104; Department of Animal Husbandry and Dairying.  
 Project Category : Applied.  
 Cost : -  
 Duration : January 1979- completed.  
 Sponsor(s) : Vidyapeeth.  
 Investigator(s) : Jagtap, G.E. and others.  
 Description : Cow milk khoa, buffalo milk khoa and whole milk powder were used as base materials i.e. for main treatments along with wheat flour and soybean flour in three different proportions resulting 18 treatment combinations. The composition and quality of gulab jamun from different combinations were also studied.

Report(s) : -

Papers Published : -

- 605 Project Title : Studies on the production and shelf-life of Phirni (an Indian sweet dish).  
 Organisation : National Dairy Research Institute, Karnal-132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-81.  
 Sponsor(s) : ICAR  
 Investigator(s) : Mathur, O.N. and others.  
 Description : The project aims to develop a standardized technique for the production of Phirni. Both cow and buffalo milks were tried and organoleptic assessment of the product was made. A suitable method for increasing its shelf-life, so that it can be utilised as a ready made sweet dish specially for armed forces and in remote areas, has been envisaged.  
 Report(s) : -  
 Papers Published : -
- 606 Project Title : Studies on storage of burfi.  
 Organisation : Central Food Technological Research Institute, Mysore-570 013; Lipid Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 10,500/-.  
 Duration : March 1979-Dec. 1979  
 Sponsor(s) : Institute.  
 Investigator(s) : Ramanna, B.R. and others.  
 Description : Burfi as prepared and stored commercially has a shelf-life of 5-6 days at ambient temperature. Incorporation of sorbic acid 0.15% level in burfi formulation prevented the attack by mold for minimum 90 days. However product hardened during storage. By proper packaging air tight in polycell paper, followed by wrapping in polyethylene pouch properly sealed, hardening could be minimised. The product at ambient temperature (27 C) was found to be acceptable for 90 days.  
 Report(s) : -  
 Papers Published : -
- 607 Project Title : Standardisation of recipe and improvement of the methods of preparation and packaging of conventional savour foods.  
 Organisation : Central Food Technological Research Institute, Experiment Station, Ludhiana 141 006.  
 Project Category : Applied.  
 Cost : Rs. 40,900/-  
 Duration : May 1976 - March 1979  
 Sponsor(s) : Institute.  
 Investigator(s) : Mookerji, K.K. and others.  
 Description : Urad wadian was dehydrated in a cross-flow dehydrator and operational data collected. Samples of urad wadian, moong wadian, phul wadian, mukand wadian and other savoury foods were studied for physico-chemical properties and draft standards were formulated for 4 types of wadian. Storage qualities of wadian and other savoury foods packed in friction-top cans or LDPE bags of 100, 200, 300 and 400 gauge were studied. LDPE of gauge 200 and above were found suitable as also the friction top cans. The product were also studied for microbial loads.  
 Report(s) : Final.  
 Papers Published : -



608 Project Title : Development of technology suitable for the rural sector for traditional expanded snack products.

Organisation : Central Food Technological Research Institute, Experiment Station, Nagpur.

Project Category : Applied/developmental.

Cost : Rs. 82,000/-.

Duration : April 1970-March 1981.

Sponsor(s) : CSIR

Investigator(s) : Laul, M.S. and others.

Description : Effort were made to improve product quality and nutritional characteristics of gold finger (tubular shaped snack food) by suitable recipe development and process improvement. Notable improvement was to incorporate defatted oilseed and legume flours to obtain formulations containing 16% protein. A screw type vertical cooker-cum-extruder based on friction principle was designed to remove deficiencies in the existing machine. The total technology packet developed for protein enriched extruded fingers based on locally available materials, was made available for adoption at village cottage levels.

Report(s) : Final

Papers Published : -

609 Project Title : Increasing the quality and shelf-life of papads

Organisation : Food Craft Institute, Shivaji Nagar, Pune 411 005.

Project Category : Applied.

Cost : Rs. 500/-.

Duration : 1982-1983.

Sponsor(s) : Institute.

Investigator(s) : Gangolli, V.A. and others.

Description : Different types of papads from pulses and tuber vegetables prepared and efforts were being made to increase their shelf life by improved methods of packaging and preservation.

Report(s) : -

Papers Published : -

#### Milk and milk products

610 Project Title : Concentration of milk and fruit juices by reverse osmosis/ ultrafiltration.

Organisation : Central Salt and Marine Chemicals Institute, Bhavnagar 364 002.

Project Category : Applied.

Cost : Rs. 1,00,000/-.

Duration : April 1980-March 1983.

Sponsor(s) : Institute.

Investigator(s) : Rangarajan, R. and others.

Description : The objective of the project is to achieve 3 to 4 fold increase in concentration of fruit juices and milk so that they can be marketed as canned products. The work is concerned with concentration using osmotic membranes.

Report(s) : Annual.

Papers Published : -

611 Project Title : Operation flood I and II ( a national project for integrated dairy development).

Organisation : Indian Dairy Corporation, Baroda 390 005.

Project Category : Survey.

Cost : Phase 1&2 Rs. 601 crores.

Duration : 1970-1985.

- Sponsor(s) : Government of India, Ministry of Agriculture.  
Investigator(s) : Kurien, V. and others.  
Description : The project is a co-operative venture to enable some 10 million milk producers and families to build a viable self sustaining dairy industry; to enable milk producers to rear a National milk herd to some 14 million animals; to erect a National Milk Grid which will link the rural milk sheds to the major demand centres; to develop infrastructure required to support a viable national dairy industry; and to increase the per capita availability of milk.
- Report(s) : Monthly, quarterly, half yearly and annual reports.  
Papers Published : -
- 612 Project Title : All India Coordinated Research Programme on the production, packaging and preservation of indigenous milk products.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1974-1979.  
Sponsor(s) : Institute.  
Investigator(s) : Rajorhia, G.S.; Srinivasan, M.P.  
\*502
- 613 Project Title : Studies on dielectric properties of milk and indigenous milk products.  
Organisation : National Dairy Research Institute, Karnal.  
Project Category : Applied.  
Cost : -  
Duration : 1979-1982.  
Sponsor(s) : ICAR  
Investigator(s) : Sharma, G.S. and others.  
Description : Suitability of sample cells for measuring the dielectric properties is being tested. Further trials are to follow.  
Report(s) : -  
Papers Published : -
- 614 Project Title : Study of the selection rate of milk and its major constituents in cow, buffalo and goats.  
Organisation : National Dairy Research Institute, Karnal.  
Project Category : Applied.  
Cost : -  
Duration : 1981-1985.  
Sponsor(s) : ICAR  
Investigator(s) : Ludri, R.S.; Singhal, K.K.  
Description : Heavier animals (buffaloes) consumed more dry matter than cross bred cows at equal level of milk production. However, when expressed as per unit metabolic body size, the cross breeds were found to be higher consumers of dry matter than buffaloes and indigenous cows. Milk of buffaloes and indigenous cows contained more fat and protein than cross bred cow milk; these gross and net energetic efficiencies of metabolisable energy for milk production were higher in the former than in latter.  
Report(s) : -  
Papers Published : -
- 615 Project Title : Studies on extent of replacement of standardised milk by soy milk in the manufacture of dairy products.  
Organisation : University of Agricultural Sciences; Veterinary College, Hebbal, Bangalore 560 024.



- Project Category : Applied.  
 Cost : -  
 Duration : December 1977-1979.  
 Sponsor(s) : University.  
 Investigator(s) : Atmaram, K.; Jagannath Rao, K.V.  
 \*503
- 616 Project Title : Survey of the chemical quality of dairy products available in the market.  
 Organisation : National Dairy Research Institute; Southern Regional Station, Adugodi, Bangalore 560 040.  
 Project Category : Applied and survey.  
 Cost : -  
 Duration : 1976-  
 Sponsor(s) : Institute.  
 Investigator(s) : Sebastian, J. and others.  
 \*504
- 617 Project Title : Pyruvate estimation to assess the hygienic quality of milk.  
 Organisation : National Dairy Research Institute, Karnal 132 001; Dairy Bacteriology Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979-1981.  
 Sponsor(s) : ICAR  
 Investigator(s) : Sondhi, H.S.; Neelakantan, S.  
 Description : Effect of temperature (7, 20 and 37 C) and periods (3, 6, 9 and 12 hours) of incubation of fresh raw cow milk and buffalo milk on total bacterial count, pyruvate content, titrable acidity, clot on boiling and alcohol test was studied.  
 Report(s) : -  
 Papers Published : -
- 618 Project Title : Development of simple test for predicting the keeping quality of pasteurised milk.  
 Organisation : National Dairy Research Institute, Southern Regional Station, Adugodi, Bangalore.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Krishnappa, N. and others.  
 Description : The accelerated methylene blue reduction test was used. The accelerated nutrients tried were yeast extract and beef extract at 0.5% concentration. After adding the nutrients, the milk was preincubated at 30 C and 37 C for one hour and the test was carried out in the usual way. Results showed that if pre-incubated pasteurised milk at 37 C with beef extracts gives an MBR time of 0.15 min or more, the keeping time of such milk at ambient temperature would be more than 10 hours. Similar data could be obtained with yeast extract and incubation at 30 C.  
 Report(s) : -  
 Papers Published : -
- 619 Project Title : Studies on enterotoxigenic organisms in dairy products.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1976-1979.

Sponsor(s) : Institute.  
 Investigator(s) : Batish, V.K. and others.  
 \*507

- 620 Project Title : Transfer of organochlorine pesticide from feed into milk and body fat of ruminants.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1982-1984.  
 Sponsor(s) : ICAR  
 Investigator(s) : Singhal, K.K.; Mudgal, V.D.  
 Description : The pesticide residues of feed and animal products and their effects on rumen metabolism are being estimated.  
 Report(s) : -  
 Papers Published : -
- 621 Project Title : Genetic architecture of milk constituents in dairy animals (buffaloes, cattle and goats).  
 Organisation : National Dairy Research Institute, Karnal 132 001  
 Project Category : Pure  
 Cost : -  
 Duration : 1979-1985  
 Sponsor(s) : ICAR  
 Investigator(s) : Chawla, D.S. and others.  
 Description : Two trials were conducted to study the influence of refrigerated storage of milk for 3 days on milk components (fat and protein %). Pooled milk samples of 20 cows were analysed. Average fat % decreased from  $4.92 \pm 0.20$  (0 day) to  $4.68 \pm 0.11$  (48 hours) and protein % increased from  $3.14 \pm 0.21$  (0 day) to  $3.29 \pm 0.08$  (48 hours). Similar studies were conducted with pooled buffalo and goat milk samples.  
 Report(s) : -  
 Papers Published : -
- 622 Project Title : Detection and characterisation of heat stable and heat labile enterotoxins of enteropathogenic E. coli from dairy products.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977-1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Singh, R.S.; Batish, V.K.  
 \*508
- 623 Project Title : Studies on enteropathogens in milk and milk products.  
 Organisation : National Dairy Research Institute, Southern Regional Station, Bangalore.  
 Project Category : Applied and survey.  
 Cost : -  
 Duration : 1978-1981.  
 Sponsor(s) : ICAR  
 Investigator(s) : Ashfaq Ahmed; Nambudripad, V.K.N.  
 Description : Market ice cream and kulfi samples (253 numbers) were analysed for total plate count and incidence of Salmonella. Four isolates resembled Salmonella and two of them were non mobile. The strains identified by serotyping and phage typing were S. paratyphi-B, S. typhi and S. gallinarum. Besides the Salmonella, 179 enterobacteriaceae were also isolated. The antibiotic resis-



tance of the Salmonella strains and enterobacteriaceae were tested against 10 selected antibiotics. The salmonella strains were sensitive to all antibiotics and of the enterobacteriaceae, two isolates were resistant to five antibiotics, seven were resistant to four antibiotics, one was resistant to three antibiotics, fifteen were resistant to two antibiotics and forty-five were resistant to only one antibiotic.

Report(s) : -  
Papers Published : -

624 Project Title : Studies on the bacteriological quality of reconstituted and recombined milk.  
Organisation : National Dairy Research Institute, Karnal 132 001; Dairy Bacteriology Department.  
Project Category : Applied.  
Cost : -  
Duration : 1975-1981.  
Sponsor(s) : ICAR  
Investigator(s) : Gupta, R.C.; Nambudripad, V.K.N.  
Description : Cultured recombined milk prepared using various cultures were inoculated with Salmonella typhosa. In recombined milks prepared from S. cremoris, S. lactis, and one market data culture, S. typhosa survived for 2-6 days after which it was completely destroyed. The bacteriological quality of recombined milk was not influenced by the quality of water supply at 4 C and 7 C for 5-10 days. In all cases the coliform count was nil. The psychophilic count increased with storage temperature and time. It was found that the coliform test used was less sensitive indicator of post pasteurisation contamination as no correlation existed between coliform and psychophilic counts.

Report(s) : Annual.  
Papers Published : -

625 Project Title : Studies on germination of spores and growth of spores forming bacteria in milk and milk products.  
Organisation : National Dairy Research Institute; Southern Regional Station, Adugodi, Bangalore 560 030  
Project Category : Fundamental and applied.  
Cost : -  
Duration : 1977-1979.  
Sponsor(s) : Institute.  
Investigator(s) : Renuka Padaki, T.G. and others.  
\*509

626 Project Title : Studies on enumeration of Coliform bacteria in milk and milk products.  
Organisation : National Dairy Research Institute, Southern Regional Station, Adugodi, Bangalore.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : ICAR  
Investigator(s) : Sudha, V.; Nambudripad, V.K.N.  
Description : Trials were conducted on milk and milk products from different regions. Five different media were used and after inoculation incubation was carried out at 37 C for 48 hrs. In case of pasteurised milk, maximum count in all media was more than 240 /ml and the minimum was less than one. Data obtained in the course of the subject are being analysed.

Report(s) : Annual.  
 Papers Published : 1. Ghodekar, D.R. and others. Coliform bacteria in dried milks. Indian J. Dairy Sci. 33(4); 1980; 490  
 2. Sudha, V. and Natarajan, A.M. Whey agar medium for enumeration of total bacterial count in milk. Cheiron. 11; 1982; 3

\*510

Project Title : Combined use of gamma irradiation and sorbic acid for preservation of indigenous evaporated milk.  
 Organisation : Bhabha Atomic Research Centre, Bombay 470 085.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Bongirwar, D.R.; Kumta, U.S.  
 Description : -  
 Reports : -  
 Papers Published : 1. Bongirwar, D.R. and Kumta, U.S. Combined use of gamma-irradiation and sorbic acid for preservation of indigenous evaporated milk product, khoa. Food Irradiation. 8(1/2); 1967; 16

628 Project Title : Studies on variation in characteristics of enterotoxigenic Staphylococci  
 Organisation : National Dairy Research Institute, Southern Regional Station, Audugodi, Bangalore.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1978-1981.  
 Sponsor(s) : ICAR  
 Investigator(s) : Mahadev, B.S.; Nambudripad, V.K.N.  
 Description : Several isolates of S. aureus S 6 were tested for variation in producing L-hemolysin coagulase and thermostable D-nase. All were positive except one which failed to produce L-hemolysin. Certain strains of S. aureus ABDE were heat resistant and showed variations in colony formation, mannitol and glucose fermentation and phosphatase and D-nase production. Passing through lactose sodium chloride broth twice and then through BHT thrice aided recovery in phosphatase production and glucose and mannitol fermentation. Other factors studied are the effect of vacuum concentration, pH and NaCl concentration on standard strains of S. aureus S6.  
 Report(s) : Annual report.  
 Papers Published : -

629 Project Title : Studies on the growth and activity of enterotoxigenic Staphylococci in dairy products.  
 Organisation : National Dairy Research Institute; Southern Regional Station, Aduogodi, Bangalore 560 030.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977-1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Nambudripad, V.K.N. and others.  
 \*512

630 Project Title : Determination of lactic acid in milk and milk products.  
 Organisation : National Dairy Research Institute, Karnal 132 001.



Project Category : Pure.  
 Cost : -  
 Duration : 1978-1980.  
 Sponsor(s) : ICAR  
 Investigator(s) : Investigations were carried out to ascertain the quantities of true lactic acid content in fresh cow and buffalo milks and to fix up the normal permissible limits in these milks with a view to detect the added neutralizers. 58 milk samples comprising of individual and pooled samples of fresh cow and buffalo milks were collected from Institute's farm and analysed. The same milk samples were then incubated at 37 C and stored at about 8 C. It was observed that buffalo milk samples had slightly higher titratable acidity and true lactic acid content as compared to cow milk samples. The increase in these factors was proportional to the period of storage.

Report(s) : -  
 Papers Published : -

631 Project Title : Effect of heat and lactic acid production on the inactivation of Staphylococcal enterotoxins.  
 Organisation : National Dairy Research Institute, Karnal 132 001; Dairy Bacteriology Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Singh, R.S. and others.  
 Description : 76 samples of milk and milk products were examined for staphylococci. Of the 47 strains of the organisms isolated 12 were coagulase positive 10 were D-nase positive, 2 were positive for enterotoxin A and 1 for enterotoxin B. The last two were also positive for thermostable nuclease activity. In mastitis samples incidence of organisms was significantly higher. Inactivation studies on the organism and the toxins were also carried out.

Report(s) : -  
 Papers Published : -

632 Project Title : Studies on biochemical, physiological and toxigenic characteristics of Enterococci isolated from milk and milk product.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Batish, V.K.; Ranganathan, B.  
 Description : Nine samples of spray dried products (SMP) and 3 of infant foods were examined for enterococci. The total plate counts ranged from  $39 \times 10^2/g$  to  $86 \times 10^2/g$  and the enterococcal count from 10 g to  $31 \times 10^2/g$ . Out of 72 "true enterococci" isolates, 10 produced thermonuclease, 9 produced gelatinase and 11 were hemolytic. 19 were resistant to penicillin neosycin, novobiosin and streptomycin. The most common enterocin type was X-9. In human and bovine faecal and urine samples (24 nos), total plate counts averaged 36/ml in bovine urine and  $29 \times 10^7/g$  in bovine dung. However, the enterococcal count ranged from 10/ml (in water) to  $91 \times 10^3/g$  (human faecal matter). Thirty two isolates were characterised as "true enterococci" and only one produced thermonuclease. The true enterococci were identi-

fied as *S. faecalis*. The most prevalent enterocin types were X-9, 65-603, 10541 and 815-2. Staphylococcal group D antigen was prepared from a standard strain HCTC and tested. Other factors studied were growth and D'Nase production in milk inocuated with a toxigenic strain and the heat resistance of hemolytic strain BF-100 in milk.

- Report(s) : -  
Papers Published : 1. Batish, V.K. and others. Characterisation of deoxyribonuclease positive enterococci isolated from milk and milk products. J. Food Prot. 45; 1982; 348.  
2. Rao, K.S. and others. Screening of kulfi for Staphylococcal enterotoxins with thermonuclease test. J. Food Prot. 43; 1980; 49
- 633 Project Title : Studies on pesticide residues in milk and milk products in India.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Survey.  
Cost : -  
Duration : 1979-1981.  
Sponsor(s) : ICAR  
Investigator(s) : Ramakrishnan, N.; Roy, N.K.  
Description : The project aims to detect and estimate the presence of various organochlorine and organophosphorus pesticides and insecticides, which are being used in modern agricultural farming, in milk from markets, dairy farms, dairy plants and factories from different localities of India. It is observed that all the samples of milk, milk products like curd and ghee, and feeds and fodders were contaminated with pesticides like DDT, its metabolites DDD and DDE, various isomers of BHC and aldrin.  
Report(s) : -  
Papers Published : -
- 634 Project Title : Pyruvate estimation to assess the hygienic quality of milk.  
organisation : National Dairy Research Institute, Karnal, 132 001.  
Project Category : -  
Cost : -  
Duration : -  
Sponsor(s) : ICAR  
Investigator(s) : Sondhi, H.S.; Neelakantan, S.  
Description : Effects of temperature (7, 20 and 37 C) and periods (3, 6, 9 and 12 hours) of incubation of fresh raw milk (cow and buffalo) on total bacterial count, pyruvate content, titratable acidity, clot on boiling and alcohol tests are studied.  
Report(s) : -  
Papers Published : -
- 635 Project Title : Effect of age of animal on the physico-chemical status of milk lipids.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1977-1981.  
Sponsor(s) : ICAR  
Investigator(s) : Darshan Lal; Narayanan, K.M.  
Description : The project proposes to gain basic knowledge on the effect of progressive lactation number of buffalo/cow on the physico-chemical status of milk lipids. The correlation between lactation number and fat percentage was not significant in Tharparkar,



- Red Sindhi, Karan-Swiss (Zero) cows and Murrah buffaloes, and was significant in Sahiwal cows.
- Report(s) : Annual.
- Papers Published : -
- 636 Project Title : Studies on the status of certain toxic minerals in milk from various sources in India.
- Organisation : National Dairy Research Institute, Karnal 132 001.
- Project Category : Survey.
- Cost : -
- Duration : 1979-1981.
- Sponsor(s) : ICAR
- Investigator(s) : Sindhu, J.S.; Roy, N.K.
- Description : The project aims to determine the concentrations of toxic minerals in samples of milk. Different methods were compared to check their accuracy and suitability.
- Report(s) : -
- Papers Published : 1. Sindhu, J.S. and Roy, N.K. Distribution of radioactive  $\text{Ca}^{45}$  between soluble and colloidal phases in buffaloes' milk as affected by processing. J. Sci. Food Agric. 33; 1982; 299  
2. Sindhu, J.S. and Roy, N.K. Distribution of radioactive  $\text{P}^{32}$  in buffaloes' skim milk as affected by processing. J. Sci. Food Agric. 33; 1982; 792
- 637 Project Title : Studies on the chemistry of thiobarbituric acid (TBA) test.
- Organisation : National Dairy Research Institute, Karnal 132 001.
- Project Category : Applied.
- Cost : -
- Duration : 1980-1982.
- Sponsor(s) : ICAR
- Investigator(s) : Des Raj; Jani, M.K.
- Description : The mechanism of reactions involved in thiobarbituric acid (TBA) test applied to oils and fats is elucidated and the conditions for its application to the milk products are standardized.
- Report(s) : Annual report.
- Papers Published : -
- 638 Project Title : Studies on thermotolerant organisms in raw milk.
- Organisation : National Dairy Research Institute, Southern Regional Station, Audugodi, Bangalore.
- Project Category : Applied.
- Cost : -
- Duration : 1979-1981.
- Sponsor(s) : ICAR
- Investigator(s) : Sudha, V. and others.
- Description : Sixty samples of farm raw milk were tested for total bacterial count and thermotolerant count at 30 C for 72 hours. The samples included raw milk from cattle yard, dairy and buffalo milk produced during different seasons. The total bacterial count and thermotolerant count respectively ranged from  $3.5 \times 10^4/\text{ml}$  to  $5.2 \times 10^6/\text{ml}$  and  $3.3 \times 10^4/\text{ml}$  to  $1.6 \times 10^6/\text{ml}$  for cattle yard raw milk, from  $4.7 \times 10^5/\text{ml}$  to  $6.6 \times 10^7/\text{ml}$  and  $1.62 \times 10^4/\text{ml}$  to  $0.9 \times 10^6/\text{ml}$  for dairy milk, and from  $1.8 \times 10^5/\text{ml}$  to  $1.8 \times 10^7/\text{ml}$  and  $16 \times 10^4/\text{ml}$  to  $1.25 \times 10^6/\text{ml}$  for buffalo milk. Morphological studies made on 300 random isolates from the above indicated that most of them comprised of diplococci, Sarcinae, spore forming rods and short rods. Further identification studies are in progress. Studies will also continue with village milk samples.

- Report(s) : —  
 Papers Published : 1. Sudha, V. and Natarajan, A.M. Whey agar medium for enumeration of total bacterial count in milk. Cheiron 11; 1982; 3
- 639 Project Title : Keeping quality and shelf life of indigenous dairy products.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : —  
 Duration : 1976-1978.  
 Sponsor(s) : Institute.  
 Investigator(s) : Roy, N.K.; Bhattacharya, D.C.  
 \*505
- 640 Project Title : Nutritive value of indigenous products of milk.  
 Organisation : National Dairy Research Institute, Southern Regional Station, Audugodi, Bangalore.  
 Project Category : Applied.  
 Cost : —  
 Duration : 1980-  
 Sponsor(s) : ICAR  
 Investigator(s) : Rao, R.V.; Balasubramanya, N.N.  
 Description : Biological value and digestibility of chhana diet ranged from 87 to 89 as compared to casein diet (reference) which were 98 and 97 respectively. Not much difference was found in haemoglobin content of rats fed the diet. The content of vitamins in khoa, chhana and milk respectively were 28,32 and 35 mg of vitamin A, 0.02, 0.01 and 0.02 µg of vitamin D. 0.02,0.02 and 0.03 mg of B<sub>1</sub>, 0.1, 0.15,0.1 mg of B<sub>2</sub> and 0.1 mg of nicotinic acid.  
 Report(s) : Annual.  
 Papers Published : 1. Balasubramanya, N.N. and Rao, R.V. Nutritive value of acidophilus milk produced by Lactobacillus acidophilus III. Indian J. Home Sci. 13; 1980; 50
- 641 Project Title : A modified colorimetric method for determination of sucrose in condensed milk.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : —  
 Duration : 1980-  
 Sponsor(s) : ICAR  
 Investigator(s) : Pantulu, P.C. and others.  
 Description : Earlier method for ice cream employing Seliwinaffs colour reaction made it possible to estimate sucrose in the presence of lactose. This method has been modified employing HTST for colour development without much interference of the degradation products of carbohydrates at higher temperatures.  
 Report(s) : —  
 Papers Published : —
- 640 -Project Title : Quantification of lysozyme from cow, buffalo and goat milk and colostrum by rocket immunoelectrophoresis.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : —  
 Duration : 1980-  
 Sponsor(s) : ICAR  
 Investigator(s) : Bhatia, K.L. and others.  
 Description : The antibodies raised against cow, buffalo and goat milk and



colstrum when tested through immuno diffusion and immunoelectrophoresis. This showed that HUL is antigenically similar to milk lysozyme in contrast to egg white lysozyme which failed to cross react against milk lysozyme of the above species.

Report(s) : -  
Papers Published : -

- 643 Project Title : Non-polar lipids of fat globule membrane.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1973-1982.  
 Sponsor(s) : ICAR  
 Description : Distribution of glycerides, cholesterol, carbonyls and fatty acids in various phases of milk such as whole milk, cream, core, skim milk and MFGM (milk fat globule membrane) have been investigated.  
 Report(s) : -  
 Papers Published : -  
 Investigator(s) : Bindal, M.P. and others.
- 644 Project Title : Studies on the poly-unsaturated fatty acids of milk fat.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-.  
 Sponsor(s) : ICAR  
 Investigator(s) : Ramamurthy, M.K. and others.  
 Description : The production of carbonyls during autoxidation of low and high melting fractions of milk fat was studied. The nature and quantities of different carbonyls depended on the fraction of mix fat autoxidised. The observed differences in the quantities of carbonyls were attributed to the differences in amounts of different polyunsaturated fatty acids present in low and high melting fractions of milk fat.  
 Report(s) : Annual  
 Papers Published : 1. Bhat, G.S. and others. Autoxidation of milk. I. Development of carbonyls and peroxides during storage of cow and buffalo milk. Milchwissenschaft. 35; 1980; 284.  
 2. Bhat, G.S. and others. Autoxidation milk. II. Production of carbonyls during autoxidation of carbonyl free buffalo milk fat. Milchwissenschaft, 35; 1980; 681  
 3. Bhat, G.S. and Rama Murthy, M.K. Production of carbonyls during spontaneous oxidation of cow and buffalo milk. J. Dairy Sci., 64; 1981; 588
- 645 Project Title : Biological availability of calcium from diets composed of milk, cereals and leafy vegetables.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980:  
 Sponsor(s) : ICAR  
 Investigator(s) : Kansal, V.K.; Deodhar, A.D.  
 Description : The mineral contents like calcium, phosphorus and magnesium of cow and buffalo milk, milk products (paneer, khoa, cottage cheese, cheddar cheese, processed cheese, cheese spread powder and skim milk powder); infant foods (Amul Spray, Liver Spray, Indec, Sapan); weaning foods (Balamul, Farex, Nestum - all

family cereal, Nestum - rice, Soy-whey and Cerealac) were assessed.

Report(s) : Annual.  
Papers Published : 1. Kansal, V.K. and Chaudhary, S. Biological availability of calcium, phosphorus and magnesium from dairy products. Milchwissenschaft 37; 1982; 261

646 Project Title : Biological availability of riboflavin from different milk products.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1980-  
Sponsor(s) : ICAR  
Investigator(s) : Deodhar, A.D.; Sharma, R.K.  
Description : Biological availability of riboflavin in different milk products was assessed. The studies showed marked variation with goat milk and dried skim milk showing superiority over buffalo milk and curd respectively. However, overall availability of the vitamin from milk products was distinctly better than the synthetic vitamin.  
Report(s) : Annual.  
Papers Published : -

647 Project Title : Nutritive value of milk treated with hydrogen peroxide.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1980-  
Sponsor(s) : ICAR  
Investigator(s) : Deodhar, A.D.; Mehta, A.K.  
Description :  $H_2O_2$  treatment was found to reduce the nutritional parameters like B.V. and amino acid availability particular methionine.  
Report(s) : Annual.  
Papers Published : -

648 Project Title : A comparative study on the determination of SNF in milk by calculation.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Fundamental and applied.  
Cost : -  
Duration : 1980-  
Sponsor(s) : ICAR  
Investigator(s) : Bector, B.S.  
Description : The effects of preservative (formalin) and adulteration of milk with water on the estimation of SNF in milk were studied. It was observed that SNF content of cow and buffalo milk samples diluted with water did not decrease proportionately as the amount of water added.  
Report(s) : Annual.  
Papers Published : 1. Rao, S.R.M. and Bector, B.S. A comparative study on the determination of solids-not-fat in milk by calculation. Indian J. Dairy Sci. 33; 1980; 1

649 Project Title : Studies on germination of spores and growth of spore forming bacteria in milk and milk products.  
Organisation : National Dairy Research Institute, Southern Regional Station, Audugodi, Bangalore.  
Project Category : Applied.



- Cost : -  
Duration : -  
Sponsor(s) : ICAR  
Investigator(s) : Renuka Padaki, T.G. and others.  
Description : Cystine influenced germination of all the spores (vegetative cells) of *B. cereus* in 3 hours incubation at 37 C. At higher concentrations of cystine (24.9% and 33.2%) germination was total at the end of 2 hours. The vegetative cells increased to maximum in 2 hours of incubation. Cystine influenced growth and germination of *B. cereus* in broth as well as in sterilised and sweetened condensed milks at higher concentrations.
- Report(s) : Annual report.  
Papers Published : 1. Natarajan, A.M. Studies on the influence of various agents on germination of spores (in vitro) in heat treated milk and their effect on keeping quality. *Cheiron*. 9; 1980; 171
- 650 Project Title : Studies on physico-chemical and immunological properties of lactoferrin isolated from buffalo, cow and goat milk.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1977-1983.  
Sponsor(s) : ICAR  
Investigator(s) : Bhatia, K.L. and others.  
Description : The level of lactoferrin present in dry secretions, colostrum and milk are studied and the structural aspect of this protein with a view to find its immunological role is investigated.
- Report(s) : Annual.  
Papers Published : -
- 651 Project Title : Effect of sterilization on recombined milk.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1977-1981.  
Sponsor(s) : ICAR  
Investigator(s) : Tandon, K.C. and others.  
Description : The project aims to study the utilisation of recombined milk to augment the supply of fluid milk in big cities. The chemical and bacteriological changes of sterilization, effect of storage on its keeping quality, and its probable use as a soft-drink are also studied.
- Report(s) : Annual.  
Papers Published : -
- 652 Project Title : Studies on the formation of carbonyl compounds and their significance in milk and milk fat.  
Organisation : National Dairy Research Institute, Southern Regional Station, Audugodi, Bangalore.  
Project Category : Applied.  
Cost : -  
Duration : 1979-1981.  
Sponsor(s) : ICAR  
Investigator(s) : Vijayendra Rao, D.; Rama Murthy, M.K.  
Description : The carbonyl compounds formed especially by non-oxidative reactions during handling and storage of market milk, cream, butter and butter oil were isolated and identified. The significance of such carbonyls in development of off flavours, directly or through interaction in the above milk and milk products, was also evaluated.

- Report(s) : Annual.  
Papers Published : 1. Vijayendra Rao, D. and Ramamurthy, M.K. Production of monocarbonyl compounds during ripening of cream by lactic cultures. *Milchwissenschaft*. 37; 1982; 601
- 653 Project Title : Determination of lactic acid in milk and milk products.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1976-.  
Sponsor(s) : Institute.  
Investigator(s) : Sharma, B.B.; Narayanan, K.M.  
\*513
- 654 Project Title : Studies on the packaging of desiccated and coagulated indigenous dairy products in flexible polyfilms and laminates.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1973-.  
Sponsor(s) : Institute.  
Investigator(s) : Gyanendra Kumar; Srinivasan, M.R.  
\*515
- 655 Project Title : Studies on the packaging of flavoured milk in flexible poly films.  
Organisation : National Dairy Research Institute, Western Regional Station, Bombay.  
Project Category : Applied.  
Cost : -  
Duration : 1981-1983.  
Sponsor(s) : ICAR  
Investigator(s) : Gyanendra Kumar.  
Description : Efficiency of selected indigenous plastic films being compared with glass bottles for packaging of flavoured milk at refrigerated conditions.  
Report(s) : Annual.  
Papers Published : -
- 656 Project Title : Microbial changes in milk stored under refrigeration conditions.  
Organisation : National Dairy Research Institute; Southern Regional Station; Aduvodi, Bangalore 560 030.  
Project Category : Applied.  
Cost : -  
Duration : 1974-.  
Sponsor(s) : Institute.  
Investigator(s) : Natarajan, A.M.; Nambudripad, V.K.N.  
\*516
- 657 Project Title : Role of anaerobic bacteria during processing and storage of canned milk products.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1979-1981.  
Sponsor(s) : ICAR  
Investigator(s) : Sinha, R.N. and others.  
Description : Samples of milk at the end of vacuum concentration and sweetened condensed milk samples from a commercial dairy were screened for anaerobic spore formers (*Clostridia*). The *Clostridia*



counts in the samples were 0 to 1100/100 ml and 0 to 590/100 g respectively. The isolates (120 nm) from samples were purified and characterised for identification. The percentage distribution of different species in concentrated milk was *Clostridium butyricum* (7), *C. perfringens* (23) and *C. sporogenes* (61). In condensed milk the percentage distribution was *C. butyricum* (75) and *C. perfringens* (20). There were certain differences in the heat resistance characteristics of these spores. The spores of *C. sporogenes* survived upto 120 C/5 min while those of *C. perfringens* and *C. butyricum* survived upto 115 C/10 min.

Report(s) : Annual.  
Papers Published : -

- 658 Project Title : Fortification of milk with Vitamin A.  
Organisation : Government of India; Ministry of Agriculture and Irrigation; Krishji Bhavan, New Delhi 110 001; Department of Food; Food and Nutrition Board.  
Project category : Applied.  
Cost : Rs. 6,00,000/-.  
Duration : 1977-1981.  
Sponsor(s) : Food and Nutrition Board.  
Investigator(s) : Jhala, G.M. (National Dairy Development Board, Anand).  
\*517
- 659 Project Title : The effect of sterilization temperature on nutritive value of some constituents of milk and keeping quality of cross-bred cow and buffalo milk.  
Organisation : Marathwada Agricultural University; College of Veterinary and Animal Sciences; Parbhani 431 402.  
Project Category : Applied and exploratory.  
Cost : Rs. 20,000/-.  
Duration : January 1978-December 1980.  
Sponsor(s) : University.  
Investigator : Sakhre, P.G. and others.  
\*519
- 660 Project Title : Studies on the bacteriological quality of milk produced under different conditions in the region.  
Organisation : National Dairy Research Institute; Southern Regional Station, Audugodi, Bangalore 560 030.  
Project Category : Applied.  
Cost : -  
Duration : 1974-.  
Sponsor(s) : Institute.  
Investigator : Rao, K.R.S. and others.  
\*520
- 661 Project Title : Studies on Psychrotrophs in milk.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Fundamental and Applied.  
Cost : -  
Duration : 1975-.  
Sponsor(s) : Institute.  
Investigator(s) : Sudarshnan, T.S.; Nambudripad, V.K.N.  
\*521
- 662 Project Title : Comparison of use of Promilk Tester II and Milk tester (MK-III) with the standard methods of analysis of protein and fat.  
Organisation : National Dairy Research Institute, Karnal 132 001.

- Project Category : Applied.  
 Cost :  
 Duration : 1973-  
 Sponsor(s) : Institute.  
 Investigator(s) : Ladkani, B.G.; Mulay, C.A.  
 \*523
- 663 Project Title : Estimation of protein in milk by Pro-Tester.  
 Organisation : National Dairy Research Institute; Southern Regional Station, Adugodi, Bangalore 560 030.  
 Project Category : Applied.  
 Cost :  
 Duration : 1975-  
 Sponsor(s) : Institute.  
 Investigator(s) : Krishna Rao, S. and others.  
 \*524
- 664 Project Title : Characterisation of glyco-proteins of fat globule membrane proteins of milk.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Fundamental.  
 Cost : -  
 Duration : 1976-  
 Sponsor(s) : Institute.  
 Investigator(s) : Bandyopadhyay, A.K.; Ganguli, N.C.  
 \*526
- 665 Project Title : Proteolysis of milk and milk products by certain digestive enzymes.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1975-1981.  
 Sponsor(s) : ICAR  
 Investigator(s) : Datta Roy, D. and others.  
 Description : The objective is to study the proteolysis of milk and milk products specially baby foods with a view to assess their nutritive value with regard to infant feeding. Peptic proteolysis studies on cow, buffalo and goat milks buffered at pH 2.2 revealed that cow milk proteolysed at the fastest rate followed by buffalo and goat milks. However differences between proteolysis of cow and buffalo milks were marginal while the differences between these milks and goat milk were extensive. Heated milks proteolysed at a faster rate than non heated milk. Frozen milks (raw or heat-treated) hydrolysed at a faster rate with pepsin than non-frozen milk. The two fractions (acid soluble and insoluble) formed during peptic action due to buffering were studied for the rate of hydrolysis by pepsin using TCA precipitation method. Incubation for 10 min showed initial degradation of casein. The peptides initially formed were soluble TCA soluble. Incubation with pepsin for longer periods gave small peptides. Inhibition of tryptic proteolysis by salts NaCl and KCl and the inhibition mechanism were also studied.  
 Report(s) : Annual.  
 Papers Published: : 1. Datta Roy, D. and others. Hydrolysis of milk proteins by pepsin at pH 2.2 in vitro. Dairy Guide 4(5); 1982; 21  
 2. Datta Roy, D. Effect of heating and freezing on the peptic proteolysis of cow milk. Milchwissenschaft 37; 1982; 461  
 3. Datta Roy, D. Effect of heating and freezing on the proteolysis of milk by trypsin in vitro. Indian J. Dairy Sci. 34; 1981; 83



4. Datta Roy, D. Proteolysis of milk from different species of trypsin in vitro. Milchwissenschaft. 36; 1981; 360
5. Datta Roy, D. Proteolysis of raw cow milk by pepsin in vitro. Indian J. Dairy Sci. 33; 1980; 392.
6. Datta Roy. Proteolysis of goat milk by trypsin in vitro. Indian J. Dairy Sci. 33; 1980; 510

- 666 Project Title : Studies on the enzyme lactose synthetase present in ruminant milk.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Fundamental and applied.  
 Cost : -  
 Duration : 1974-  
 Sponsor(s) : Institute.  
 Investigator(s) : Mathur, M.P.  
 \*528
- 667 Project Title : Determination of range of fat and SNF contents of milks of cattle in the region.  
 Organisation : National Dairy Research Institute; Southern Regional Station, Aduodi, Bangalore 560 030.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977-1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Sebastian, J. and others.  
 \*529
- 668 Project Title : Studies on the unsaturated fatty acids of milk fat.  
 Organisation : National Dairy Research Institute, Southern Regional Station, Aduodi, Bangalore 560 030.  
 Project Category : Fundamental and applied.  
 Cost : -  
 Duration : 1976-  
 Sponsor(s) : Institute.  
 Investigator(s) : Ramamurthy, M.K.; Rao, S.K.  
 \*531
- 669 Project Title : Studies on the picolinic acid content in milk and its role in absorption of trace elements.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1982-1984.  
 Sponsor(s) : ICAR  
 Investigator(s) : Sharma, M.K.; Deodhar, A.D.  
 Description : The project is concerned with the determination of picolinic acid in milk of different dairy animals at different stages of lactation and human milk. Studies also include interaction of various trace elements and calcium with picolinic acid as also its influence on their absorption.  
 Report(s) : Annual.  
 Papers Published : -
- 670 Project Title : Studies on the bacteriological quality of reconstituted and recombined milks.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -

- Duration : 1975-  
 Sponsor(s) : Institute.  
 Investigator(s) : Gupta, R.C.; Nambudripad, V.K.N.  
 \*532
- 671 Project Title : Studies on causes and removal of off flavours in recombined milk.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1982-1983.  
 Sponsor(s) : ICAR  
 Investigator(s) : Rama Murthy, M.K.  
 Description : Chemical changes if any, occurring in butter oil and skim milk powder during preparation of recombined milk which may be responsible for the typical off flavours observed in these milks are being studied.  
 Report(s) : Annual.  
 Papers Published : -
- 672 Project Title : Status of fat globule membrane in modified milk systems.  
 Organisation : National Dairy Research Institute, Karnal 132 001  
 Project Category : Applied.  
 Cost : -  
 Duration : 1975-.  
 Sponsor(s) : Institute.  
 Investigator(s) : Bandhyopadhyay, A.K.; Ganguli, N.C.  
 \*533
- 673 Project Title : Induction of mutation in Lactobacillus bulgaricus with particular reference to antibacterial activity.  
 Organisation : National Dairy Research Institute, Karnal 132 001; Dairy Bacteriology Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979-1981.  
 Sponsor(s) : ICAR  
 Investigator(s) : Jasjit Singh and others.  
 Description : Skim milk samples from fresh cow and buffalo milk were sterilised at 100 C for 30 minutes, inoculated with L: bulgaricus cultures, incubated at 37 C for 24 hours and centrifuged at 3000 rpm for 15 minutes. The supernatants were individually sterilised and cell free extracts were tested against food poisoning organisms like Escherichia coli, Bacillus subtilis, Staphylococcus aureus and Pseudomonas fragi. The cell free filtrate of L. bulgaricus inhibited the growth of the test organisms irrespective of the type of milk. The anti bacterial activity was more in the buffalo than in cow milk. The L. bulgaricus cells were also subjected to U.V. radiation to determine the survival rates at different radiation times.  
 Report(s) : Annual report.  
 Papers Published : -
- 674 Project Title : Detection of neutralizers in skim milk powder (SMP).  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-.  
 Sponsor(s) : ICAR  
 Investigator(s) : Singhal, O.P.; Ganguli, N.C.



- Description : More than 500 samples of cow and buffalo milk and 120 samples of skim milk powder (imported and indigenous) were analysed for developed lactic acid (DL) and titratable acidity (IA). Decrease in TA and increase of DL of the samples indicated the presence of neutralisers. On the basis of these studies it was possible to fix a lower limit of 0.9% TA and a higher limit of 0.2% for SMP. The method was efficient upto level of 0.05% of DL in milk samples and 0.5% DL in SMP samples as the recovery of LA by this method was 100, 90 and 80% at levels of 0.03, 0.04 and 0.05% LA respectively in milk and reconstituted milk samples.
- Report(s) : Annual.
- Papers Published : 1. Singhal, O.P. Adulterants and their methods of detection. Indian Dairyman. 32(10); 1981; 771
- 675 Project Title : Studies on lipids of skim milk and whey.
- Organisation : National Dairy Research Institute; Southern Regional Station, Adugodi, Bangalore 560 030.
- Project Category : Applied.
- Cost : -
- Duration : 1976-.
- Sponsor(s) : Institute.
- Investigator(s) : Ramamurthy, M.K. and others.
- \*535
- 676 Project Title : Effect of metal contamination of active sulphydryls in milk
- Organisation : National Dairy Research Institute; Southern Regional Station, Adugodi, Bangalore 560 030.
- Project Category : Applied.
- Cost : -
- Duration : 1977-1979.
- Sponsor(s) : Institute.
- Investigator(s) : Unnikrishnan, V.; Rao, R.V.
- \*538
- 677 Project Title : Effect of age of animal on the physico-chemical status of milk lipids.
- Organisation : National Dairy Research Institute, Karnal.
- Project Category : Applied.
- Cost : -
- Duration : 1977-1981.
- Sponsor(s) : ICAR
- Investigator(s) : Darshan Lal; Narayanan, K.M.
- Description : Results of analysis of different groups based on lactation number, showed that the age of animal affected significantly the cholesterol ( $P < 0.01$ ) and vitamin E content ( $P \geq 0.05$ ) whereas vitamin A was not significantly affected ( $P \geq 0.05$ ). Lactation number had also a slight effect on the physico-chemical characteristics of milk lipids.
- Report(s) : Annual.
- Papers Published : -
- \*543
- 678 Project Title : Nutritive value of milk treated with hydrogen peroxide.
- Organisation : National Dairy Research Institute, Karnal 132 001.
- Project Category : Applied.
- Cost : -
- Duration : 1976-.
- Sponsor(s) : Institute.
- Investigator(s) : Deodhar, A.D.; Srivastava, A.
- \*539

- 679 Project Title : Engineering studies on UHT processing of milk.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981-1982.  
 Sponsor(s) : ICAR  
 Investigator(s) : Anap, G.R.; Agrawala, S.P.  
 Description : An experimental model comprising of SS vat, plate type pre-heater, steam injection device, high temperature holder to change the residence time, flashing shell and tubular heat exchanger to cool the milk, has been designed, fabricated and installed. The milk is initially heated to 72 C and steam is injected into it to raise the temperature to 130 C or more. The sporicidal efficiency of the equipment was tested for different time temperature combinations. Using the equipment it was possible to have aseptically filled milk filled in sterile chamber) to obtain 1-2 months shelf life for skim milk and cow milk for different time-temperature conditions.  
 Report(s) : Annual  
 Papers Published : -
- 680 Project Title : Further studies on humanised milk in relation to manufacture and quality.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1982-1984.  
 Sponsor(s) : ICAR  
 Investigator(s) : Ganguli, N.C.  
 Description : Large scale trials are being conducted on humanised milk production, its storage quality and feeding of infants with it.  
 Report(s) : Annual.  
 Papers Published : -
- 681 Project Title : Development of milk like beverage from soybean, sesame and skim milk.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981-1983.  
 Sponsor(s) : ICAR  
 Investigator(s) : Patil, G.R. and others.  
 Description : Several combinations of soybean, sesame and skim milk were formulated on the basis of their amino acid contents on the basis of their amino acid contents to having the blends closest to FAO/WHO reference proteins. In all, 231 combinations were made and studied. Out of these 53 combinations which were not deficient in any of the essential amino acids were separated and finally 11 combinations were selected from which the beverages were prepared.  
 Report(s) : Annual  
 Papers Published : -

## Cow milk

- 682 Project Title : Studies on the growth of starter cultures in cow milk extended with soy milk.  
 Organisation : University of Agricultural Sciences; Veterinary College, Karnal.  
 Investigator(s) : Anap, G.R. and others.



- Project Category : Applied.  
 Cost : -  
 Duration : October 1978-June 1979.  
 Sponsor(s) : University.  
 Investigator(s) : Atmaram, K.; Prince Charles Cephas.  
 \*540
- 683 Project Title : Nutritional evaluation of different kinds of milk, namely whole cow milk, recombined and toned milk using rat repletion technique.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1976-  
 Sponsor(s) : Institute.  
 Investigator(s) : Deodhar, A.D.; Srivastava, A.  
 \*541
- 684 Project Title : Studies on influence of non-protein nitrogenous (NPN) compounds on heat stability of milk.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-  
 Sponsor(s) : ICAR  
 Investigator(s) : Bhat, G.S. and others.  
 Description : -  
 Report(s) : -  
 Papers Published : - \*\*677
- 685 Project Title : Nutritive value of toned and double toned milk in relation to normal (whole) cow milk.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-  
 Sponsor(s) : ICAR  
 Investigator(s) : Ghosh, SN.  
 Description : Experiments using albino rats showed that toned milk was slightly better in nutritive value than double toned milk. However, it was considered possible to improve the nutritive value to a fairly good extent.  
 Report(s) : -  
 Papers Published : -  
 \*544
- 686 Project Title : Determination of thermal conductivity, specific heat and bulk density of indigenous milk products.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981-1983.  
 Sponsor(s) : ICAR  
 Investigator(s) : Samuel, D.V.K.  
 Description : A thermal conductivity probe based on the principles of unsteady state flow of heat through solid/semisolid material was designed and fabricated. Thermocouples were placed inside the cylinder to record the change in the temperature of the material at different levels of times. Preliminary trials have already been conducted on paneer at different levels of moisture contents and bulk densities. The results are being analysed.

- Report(s) : Annual  
Papers Published : -
- 687 Project Title : Studies on direct contact heat transfer between non-condensable gas and liquid.  
Organisation : National Dairy Research Institute, Karnal.  
Project Category : Applied.  
Cost : -  
Duration : 1979-1981.  
Sponsor(s) : ICAR  
Investigator(s) : Zaidi, A.H.; Sarma, S.C.  
Description : The work was carried out in two directions simultaneously; study of basic heat transfer phenomenon and application of such heat transfer in dairy processing. In heat transfer studies, variables affecting the transfer phenomenon were fixed and a set up was designed, fabricated and assembled. Arrangement was made for control and measurement of liquid and gas temperature, and flow rates. Studies were also made on the manufacture of ghee from butter and concentrated milk to correlate the findings of heat transfer studies.  
Report(s) : Annual  
Papers Published : -
- 688 Project Title : Preparation and evaluation of acidophilus milk powder for its therapeutic and nutritional quality.  
Organisation : National Dairy Research Institute, Karnal.  
Project Category : Applied.  
Cost : -  
Duration : 1981-1982.  
Sponsor(s) : ICAR  
Investigator(s) : Kansal, V.K.; Gandhi, D.N.  
Description : Spray dried acidophilus milk powder (AMP) was prepared using standardised milk with skim milk powder, lactose and gelatin (total solids 22-25%). Total viable count was found to be 1/5 of the initial counts in the acidophilus milk (AM) before drying. The antibacterial activity of AMP was at levels similar to that of acidophilus milk. AMP as well as milk dahi and acidophilus milk reduced plasma cholesterol by 33.6%, 28.0%, 28.3% and 28.6% in rats while in control rats it was increased by 13.5%. The cholesterol and triglyceride concentrations were 37.3-41.8% and 63.8-67.2% respectively of the values observed in control group. There was a significant decrease of cholesterologenesis in liver, the effect of unaltered milk being less pronounced than that of cultured milk products. There was a reduction in hepatic efficiency to reduce NADP<sup>+</sup>; again, dahi and acidophilus milk were more effective. Feeding milk/cultured milks increased lactic bacteria counts in faeces. These were effectively suppressed by acidophilus milks and AMP.  
Report(s) : Annual.  
Papers Published : -

#### Buffalo milk

- 689 Project Title : Buffering properties of buffalo milks.  
Organisation : National Dairy Research Institute, Karnal.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : ICAR



- Investigator(s) : Malic, R.C.  
 Description : Variations in pH, buffering capacities of samples of milk with change in temperature, fat and addition of additives like sodium citrate, sodium dihydrogen orthophosphate, sodium phosphate, diboric calcium chloride and EDTA (disodium salt) were studied.  
 Report(s) : Annual  
 Papers Published : -
- 690 Project Title : Manufacture of cheddar type of cheese from buffalo milk using microbial rennet.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Bethe, N.D.; Chakraborty, B.K.  
 Description : Equal proportions of bacterial (B. subtilis) and mold (Absidia ramosa) enzymes showed slow development of acidity associated with poor cheddarising quality. Moisture retention did not also improve and the cheese was poor organoleptically in respect of flavour, body and texture. Addition of 1% salt to milk, higher pasteurisation temperature (65 C for 30 min) and setting temperature of 28 to 36 C with 2½% starch improved the quality of cheese.  
 Report(s) : -  
 Papers Published : -
- 691 Project Title : Heat induced changes in buffalo milk preceding coagulation.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1982-1985.  
 Sponsor(s) : ICAR  
 Investigator(s) : Ganguli, M.C.; Bhavadasan, M.K.  
 Description : Role of heat induced changes like modification of casein, changes in miscellar structure and decrease in pH in milk preceding coagulation is being studied.  
 Report(s) : Annual  
 Papers Published : -
- 692 Project Title : Effect of homogenization of selective nutritional characteristics of buffalo milk.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1978-1981.  
 Sponsor(s) : ICAR  
 Investigator(s) : Mehta, A.K.; Deodher, A.D.  
 Description : The factors studied were the effect of homogenization on:  
 i) curd tension of milk from various species as well as mixed milks, ii) protein and fat quality, iii) retention of certain water soluble vitamins and iv) biological availability of vitamin A.  
 Report(s) : Annual  
 Papers Published : -
- 693 Project Title : Influence of pH on the heat stability of artificial bovine and buffalo milk system.  
 Organisation-- : -

- |                  |   |   |
|------------------|---|---|
| Organisation     | : | National Dairy Research Institute, Karnal.  |
| Project Category | : | Applied.  |
| Cost             | : | -   |
| Duration         | : | 1982-1985.  |
| Sponsor(s)       | : | ICAR  |
| Investigator(s)  | : | Bhavadasan, M.K.; Ganguli, N.C.   |
| Description      | : | Role of some milk components of heat stability of artificial milk systems with special reference to change in pH is being investigated in order to understand the factors responsible for poor heat stability in the minimum of heat coagulation versus pH curve. |
| Report(s)        | : | Annual  |
| Papers Published | : | -   |
- 694 Project Title : Studies on the feasibility of production of heat classified milk powder from buffalo skim milk.
- |                  |   |  |
|------------------|---|--|
| Organisation     | : | National Dairy Research Institute, Karnal 132 001.   |
| Project Category | : | Applied.   |
| Cost             | : | -  |
| Duration         | : | 1978-1981.   |
| Sponsor(s)       | : | ICAR   |
| Investigator(s)  | : | Bhanumurthy, J.L. and others.  |
| Description      | : | The extent of whey protein denaturation during processing of buffalo skim milk to milk powder is investigated and the processing treatments for manufacture of low, medium and high fat powder is studied. |
| Report(s)        | : | -  |
| Papers Published | : | -  |
- 695 Project Title : Technological aspect of manufacture of high, medium and low calcium coprecipitate from buffalo milk.
- |                  |   |   |
|------------------|---|---|
| Organisation     | : | National Dairy Research Institute, Karnal.  |
| Project Category | : | Applied.  |
| Cost             | : | -   |
| Duration         | : | 1976-1981.  |
| Sponsor(s)       | : | ICAR  |
| Investigator(s)  | : | Mann, R.S.; Mulay, C.A.   |
| Description      | : | Different types of calcium coprecipitates were prepared and analysed for their gross composition of fat, total solids, protein, protein, lactose, ash, calcium, phosphorous and SH groups. Physical attributes (colour, bulk density, solubility index, viscosity and emulsifying capacity) were also studied. Efforts were made to use the coprecipitate in preparing certain dairy products. Ice cream prepared utilising spray dried calcium coprecipitate (to replace skim milk powder) was found highly acceptable by a sensory panel. |
| Report(s)        | : | Annual  |
| Papers Published | : | -   |
- \*564
- 696 Project Title : Studies on the utilisation of sour buffalo milk for the manufacture of edible casein.
- |                  |   |   |
|------------------|---|---|
| Organisation     | : | National Dairy Research Institute, Karnal.  |
| Project Category | : | -   |
| Cost             | : | -   |
| Duration         | : | 1977-80   |
| Sponsor(s)       | : | ICAR  |
| Investigator(s)  | : | Vijay Kumar; Mulay, C.A.  |
| Description      | : | The process was standardised. The edible casein was prepared in bulk from fresh and sour milk of acidities $0.2 \pm 0.02$ , |



0.3  $\pm$  0.02 and 0.4  $\pm$  0.02 percent and evaluated for physico-chemical, storage and nutritive quality. The product was found acceptable.

Report(s) : Annual.  
Papers Published : -

697 Project Title : A study of immunoglobulins in buffalo milk.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1976-1983.  
Sponsor(s) : ICAR  
Investigator(s) : Bhatia, K.L. and others.  
Description : While investigating to purify free secretory component (FSC) present in buffalo milk, it was observed that this component can be precipitated out at 55% ammonium sulphate concentration. In contrast, the FSC of cow milk precipitated at 40% concentration. The component was purified on DEAE-cellulose, phosphocellulose, sephadex G-200 and immunoabsorption.

Report(s) : -  
Papers Published : -  
\*558

698 Project Title : Effect of addition of aldehydes and sugars on the heat stability of buffalo milk.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1980-.  
Sponsor(s) : ICAR  
Investigator(s) : Bhavadasan, M.K. and others.  
Description : The effectiveness of the above at 140 C was assessed. Considerable improvement in heat stability was observed on the addition of aldehydes like glycoaldehyde, glyoxal and glyceraldehyde and a pentose, namely, 2-deoxyribose in milks of both buffalo and cows. Addition of ribose did not enhance heat stability of either cow or buffalo milk. All the above compounds except ribose enhanced heat stability of concentrated and or sterilised milk. The ability of these compounds to increase the heat stability was similar whether added before or after concentrating the milk. Addition of these aldehydes also brought about very large increase in stability of sterilized milk from both species. The results showed evidence that the heat stability of concentrated buffalo milk during sterilization can be significantly improved by the addition of 2-deoxyribose and some simple aldehydes.

Report(s) : Annual  
Papers Published : 1. Ghatak, P.K. and others. Effect of the addition of aldehydes or sugars on the heat stability of buffalo milk. New Zealand J. Dairy Sci. Technol. 15; 1980; 159  
2. Rajput, Y.S. and others. Heat stability of buffalo milk as affected by addition of urea and glyceraldehyde. New Zealand J. Dairy Sci. Technol. 17; 1982; 185

699 Project Title : Technological aspects of manufacture of chocolate milk powder from buffalo milk.  
Organisation : National Dairy Research Institute, Karnal. 132 001  
Project Category : Applied.  
Cost : -

- Duration : 1977-1981.  
 Sponsor(s) : ICAR  
 Investigator(s) : Abhay Kumar; Mulay, C.A.  
 Description : The objectives of the project are to standardize the technique of manufacture of chocolate milk powder utilizing buffalo milk; to study the physico-chemical properties of the chocolate milk powder; to study the theobromine tannin contents during storage and to study the keeping quality of the chocolate milk powder.  
 Report(s) : Annual.  
 Papers Published : -
- 700 Project Title : Studies on the production and shelf-life of high fat whole milk powder for the preparation of reconstituted standardized milk.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1978-1981.  
 Sponsor(s) : ICAR  
 Investigator(s) : Balachandran, R. and others.  
 Description : The technology of production of high fat buffalo whole milk powder with or without antioxidants has been standard and the shelf life of the powder and the quality by attributes of the reconstituted milk have been studied.  
 Report(s) : Annual.  
 Papers Published : -
- 701 Project Title : Trace element composition in buffalo milk and their influence on milk products.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1978-82  
 Sponsor(s) : ICAR  
 Investigator(s) : Mathur, O.N.; Roy, N.K.  
 Description : The project aims to determine (i) concentration of aluminium, boron, copper, cobalt, iron, sulphur and zinc in buffalo milk (ii) the status of a few of these e.g. Fe, Cu, S, in soluble, colloidal, organic and inorganic and (iii) the influence of some of these elements on the properties of products (both indigenous and western type) from buffalo milk.  
 Report(s) : Annual.  
 Papers Published : -  
 \*552
- 702 Project Title : Studies on the production and properties of vacuum roller dried buffalo milk powder.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-  
 Sponsor(s) : ICAR  
 Investigator(s) : Joginder Singh and others.  
 Description : Vacuum roller dried buffalo skim as well as whole milk powders were prepared under the standardised conditions and their physical and chemical characteristics were compared to atmospheric roller dried powder. Milk powder samples stored at 5 C could keep well for a longer period than those stored at 37 C. The whole milk powder samples deteriorated earlier as compared to skim milk powder samples irrespective of the method of drying.  
 Reports : -  
 Papers Published : -



- 703 Project Title : Studies on the properties of the condensed milk prepared from buffalo milk with added aldehyde and urea  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981-1982.  
 Sponsor(s) : ICAR  
 Investigator(s) : Ajit Singh and others.  
 Description : Addition of 2-deoxyribose systems showed a decrease in pH with storage time. However, with urea and synergistic systems (urea + deoxyribose) there was prominent increase in pH in the first 20 days of storage at room temperature; more with synergistic system. After 40 days the pH of synergistic system fell and more or less got stabilised. Heat stability in condensed milk with urea decreased and with 2-deoxyribose and synergistic systems increased with storage time. With controls, however, they remained constant. The viscosity was maximum with storage time in the case of deoxyribose system; it was the slowest rate of viscosity increase in synergistic system. Colour and flavour of all systems was unchanged though with deoxyribose, slight off-flavour developed after 40 days.  
 Report(s) : Annual  
 Papers Published : -
- 704 Project Title : Humanisation of buffalo milk.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1972-  
 Sponsor(s) : Institute.  
 Investigator(s) : Kuchroo, C.N.; Ganguli, N.C.  
 \*545
- 705 Project Title : Studies on some physical properties of buffalo milk and its products.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Fundamental and Applied.  
 Cost : -  
 Duration : 1971-  
 Sponsor(s) : Institute.  
 Investigator(s) : Sharma, C.S.; Roy, N.K.  
 \*546
- 706 Project Title : Studies on physico-chemical properties of fraction of buffalo milk fat.  
 Organisation : National Dairy Research Institute, Southern Regional Station, Audugodi, Bangalore.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981-1982.  
 Sponsor(s) : ICAR  
 Investigator(s) : Lakshminarayana, M.; Rama Murthy, M.K.  
 Description : Cow and buffalo milk fats were fractionated and their fractionation behaviour compared. Maximum yield of fat was with buffalo (57.6%) and the yield in cow milk fat was 53.6%, the optimum temperature being 23 C. The properties of various fractions were also studied. There were wide variations in fatty acid composition among them. There was little change in short chain fatty acids though there were marked differences

in melting points.  $CS_2$  and triglyceride contents decreased with melting points while total carbonyls, vitamin A, carotenes, tocopherol and cholesterol showed substantial increases. Rate of hydrolysis increased with decrease of melting points. In experimental cheese made from buffalo milk in which part of the fat was replaced with low melting fraction the rate of flavour development was much higher than in control. They also had more total carbonyls, monocarbonyls, total fatty acids and steam volatile fatty acids.

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| Report(s)        | : | Annual |
| Papers Published | : | —      |
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| 707 Project Title | : | Interaction of the major buffalo milk constituents during processing to evaporated milk. |
| Organisation      | : | National Dairy Research Institute, Karnal 132 011.                                       |
| Project Category  | : | Applied.   |
| Cost              | : | —  |
| Duration          | : | 1977-1979.   |
| Sponsor(s)        | : | Institute.   |
| Investigator(s)   | : | Singh, C.P.; Roy, N.K.   |
| *549              |   |  |
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|-------------------|---|---|
| 708 Project Title | : | Studies on trace components in milk fat and their role in dairy products.                 |
| Organisation      | : | National Dairy Research Institute; Southern Regional Station, Adugodi, Bangalore 560 030. |
| Project Category  | : | Applied.  |
| Cost              | : | —   |
| Duration          | : | 1974-.  |
| Sponsor(s)        | : | Institute.  |
| Investigator(s)   | : | Bhatt, G.S.; Ramamurthy, M.K.   |
| *550              |   |   |
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| 709 Project Title | : | Status of the major mineral constituents of buffalo milk and changes in it due to various processing factors. |
| Organisation      | : | National Dairy Research Institute, Karnal 132 001.  |
| Project Category  | : | Applied.  |
| Cost              | : | —   |
| Duration          | : | 1973-   |
| Sponsor(s)        | : | Institute.  |
| Investigator(s)   | : | Sindhu, J.S.; Roy, N.K.   |
| *551              |   |   |
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|-------------------|---|--|
| 710 Project Title | : | Changes in salt balance of milk during the preparation of evaporated milk. |
| Organisation      | : | National Dairy Research Institute, Karnal 132 001.                         |
| Project Category  | : | Applied.   |
| Cost              | : | —  |
| Duration          | : | 1971-.   |
| Sponsor(s)        | : | Institute.   |
| Investigator(s)   | : | Roy, N.K.; Mathur, O.N.  |
| *553              |   |  |
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|-------------------|---|---|
| 711 Project Title | : | Studies on physico-chemical and immunological properties of lactoferrin isolated from buffalo, cow and goat milk. |
| Organisation      | : | National Dairy Research Institute, Karnal 132 001.  |
| Project Category  | : | Applied.  |
| Cost              | : | —   |
| Duration          | : | 1977-1979.  |



- Sponsor(s) : Institute.  
Investigator(s) : Bhatia, K.L. and others.  
\*555
- 712 Project Title : Studies on physico-chemical behaviour of B-lactoglobulin from buffalo milk.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Fundamental and applied.  
Cost : -  
Duration : 1973-  
Sponsor(s) : Institute.  
Investigator(s) : Malik, R.C.  
\*559
- 713 Project Title : Elucidation of changes in protein fractions of buffalo milk on sterilisation and its subsequent storage at room temperature.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1976-  
Sponsor(s) : Institute.  
Investigator(s) : Tandon, K.C.  
\*565
- 714 Project Title : Significance of residual penicillin in buffalo milk.  
Organisation : National Dairy Research Institute; Karnal 132 001; Dairy Bacteriology Division.  
Project Category : Applied.  
Cost : -  
Duration : 1979-1981  
Sponsor(s) : ICAR  
Investigator(s) : Ajay Kaul; Singh, R.S.  
Description : A suitable method for residual penicillin was standardised using *Sarcina lutea*, *Bacillus subtilis* and 3 strains of *Bacillus stearothermophilus* var. *Calidolactics*. Of these *Sarcina lutea* and *B. subtilis* were less sensitive for lower levels of residues. Hence, *B. stearothermophilus* var. *Calidolactics* was selected for further study. The stable spores of this organism was prepared by a modified technique and by using the spore suspension residual penicillin upto 0.00081 could be detected after 2 hour incubation at 55 C from phosphate butter and buffalo milk.  
Report(s) : Annual  
Papers Published : -
- 715 Project Title : Biosynthesis of buffalo milk fat globule membrane lipids.  
Organisation : National Dairy Research Institute, Karnal 132 001, Dairy Chemistry Division.  
Project Category : Fundamental and applied.  
Cost : -  
Duration : 1980-  
Sponsor(s) : ICAR  
Investigator(s) : Sharma, K.C.; Ray, T.K.  
Description : The gross and lipid composition of buffalo milk fat globule membranes (MFGM) and plasma membranes (PM) were studied to elucidate the structure and function of MFGM and its relationship with PM. In vivo synthesis of MFGM lipid was also studied by injecting radioactive acetate to the same animals. The studies revealed that both MFGM and PM are of common origin and that

part of the requirement of substrates and metabolites for the synthesis of lipids of MFGM and PM are supplied by the circulating blood.

Report(s) : Annual  
Papers Published : -

716 Project Title : Determination of the nutritive value of decorticated cottonseed cake expeller/extraction vs. undecorticated cottonseed cake.  
Organisation : National Dairy Research Institute, Karnal.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : ICAR  
Investigator(s) : Mudgal, V.D.; Nawab Singh.  
Description : Effect of feeding decorticated cottonseed cake expeller/extraction and groundnut cake rations on the utilisation of feed nutrients on the one hand, and the milk production, milk composition and feed efficiency on the other hand, in buffaloes was studied. Results showed the former was in no way inferior to normal groundnut cakes but were comparable. It was also concluded that buffaloes fed with ration containing either of decorticated cottonseed cake were inferior to groundnut cake in milk production or in feed conversion efficiency.

Report(s) : Annual  
Papers Published : -

717 Project Title : Technological Studies on the manufacture of butter milk powder from buffalo milk.  
Organisation : National Dairy Research Institute, Karnal.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : ICAR  
Investigator(s) : Sitaram Prasad; Gupta, S.K.  
Description : A process was standardised for butter powder from buffalo milk for use reconstituted high-fat spread. The product does not require refrigerated storage and yet lasts for more than a year. It can be reconstituted by mixing one part of potable water with 4 parts of butter powder.

Report(s) : -  
Papers Published : -

#### Goat Milk

718 Project Title : Studies on the status of major minerals and the electrical conductance of goat's milk.  
Organisation : National Dairy Research Institute, Karnal.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : -  
Investigator(s) : Sindhu, J.S. and others.  
Description : Fifteen samples were analysed for total concentration and partitioning of seven minerals, namely, calcium, magnesium, sodium, potassium, phosphorus, citrate and chloride. Results showed that concentration of these monovalent minerals (sodium, potassium and chloride) were higher than in buffalo milk and similar to those in cow milk. However, concentrations of calcium and magnesium were lower than in buffalo milk but higher than in cow milk, citrate and phosphate were similar in



all three milks. Studies by further partitioning revealed that about 25.52% of total calcium was present in soluble phase in goat milk. The soluble proportions for other milks were 66.10% for magnesium, 56.80% for phosphorus and 81.00% for citrate. Sodium, potassium and chloride were present completely in soluble phase. Electrical conductivity tests are still to be carried out.

Report(s) : Annual  
Papers Published : -

719 Project Title : Studies on the utilisation of single cell protein in the diets of goats.  
Organisation : National Dairy Research Institute, Karnal.  
Project Category : Applied.  
Cost : -  
Duration : 1980-1981.  
Sponsor(s) : ICAR  
Investigator(s) : Mudgal (VD); Singhal, K.K.  
Description : All agro-industrial byproducts used as feed were deficient in one of the amino acids but single cell protein contained comparatively higher amino acid content possibly due to high protein content. The aspects studied were: influence of replacement of plant protein with single cell protein in nutrient utilisation in cross bred goats and effect of feeding milk and milk replacer containing single cell protein on growth and nutrient utilisation of kids. There were no differences in digestibility of the proximate principles. So also in the balance in N, Ca and P retention values per day. Single cell protein, however, was more efficient as an ingredient in the milk replacer.  
Report(s) : Annual  
Papers Published : -

#### Fermented milk products

720 Project Title : (a) Curd forming properties of goat milk, (b) Utilisation of goat milk for Shrikhand making.  
Organisation : Mahatma Phule Agricultural University, Rahuri, Dist. Ahmednagar, Maharashtra; Department of Food Science and Technology.  
Project Category : Applied.  
Cost : Rs. 40,000/-.  
Duration : June 1981-June 1983  
Sponsor(s) : Government of Maharashtra and ICAR.  
Investigator(s) : Belhe, N.D.; Kulkarni, M.B.  
Description : Curd forming properties of goat milk will be compared with those of buffalo milk. On the basis of these findings utilisation of goat milk for preparation of various dairy products will be investigated. Special attention will be paid to develop manufacturing techniques for Shrikhand from goat milk.  
Report(s) : Annual  
Papers Published : -

721 Project Title : Nutritive value of dahi and fermented milks.  
Organisation : National Dairy Research Institute; Southern Regional Station, Adegodi, Bangalore 560 030  
Project category : Fundamental and applied  
Cost : -  
Duration : 1972-  
Sponsor(s) : Institute.

- Investigator(s) : Rao, R.V. and others.  
\*570
- 722 Project Title : Studies on Lactobacillus acidophilus based fermented milk products.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1974-.  
Sponsor(s) : Institute,  
Investigator(s) : Gandhi, D.N.; Nambudripad, V.K.N.  
\*571
- 723 Project Title : Studies on the utilisation of soyamilk in combination with buffalo milk for curd preparation.  
Organisation : Punjabrao Krishi Vidyapeeth, Akola 444 104; Department of Animal husbandry and Dairying.  
Project Category : Applied.  
Cost : -  
Duration : February 1980 - June 1980.  
Sponsor(s) : Vidyapeeth.  
Investigator(s) : Tambat, R.V. and others.  
Description : Effect of various combinations of soya milk (S.M.) and buffalo milk (B.M.) viz, 100% B.M.; 75% B.M. + 25% S.M.; 50% B.M.+ 50% S.M.; 25% B.M. + 75 S.M. ; and 100% S.M. were studied. Physico-chemical properties of milk and curd and the acceptability of curd were also studied.  
Report(s) : Annual  
Papers Published : -
- 724 Project Title : Assessment of the market value of carbonated curd packed in polyethylene bags and stored at room temperature.  
Organisation : Punjabrao Krishi Vidyapeeth, Akola 444 104; Department of Animal Husbandry and Dairying.  
Project Category : Applied.  
Cost : -  
Duration : December 1981-April 1982.  
Sponsor(s) : Vidyapeeth,  
Investigator(s) : Pande, S.P. and others.  
Description : The curd was prepared using pure cultures, packed in polyethylene bags and stored at room temperature. Consumer acceptance studies have indicated that the packed curd can be stored for one month at room temperature.  
Report(s) : -  
Papers Published : -
- 725 Project Title : Antimicrobial substances in fermented milk.  
Organisation : University of Bombay, Department of Chemical Technology, Matunga Road, Bombay 400 019.  
Project Category : Applied.  
Cost : Rs. 7,000/- per annum.  
Duration : Two years.  
Sponsor(s) : University Grants Commission.  
Investigator(s) : Subbalaxmi, A.; Kulkarni, P.K.  
Description : Antimicrobial substances in fermented milk and curd are being characterised.  
Report(s) : -  
Papers Published : -



- 726 Project Title : Studies on preparation of Koumiss from cow and buffalo milk.  
 Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani 431 402; Department of Food Science and Technology.  
 Project Category : Applied.  
 Cost : Rs. 3,000/-.  
 Duration : August 1980-August 1982.  
 Sponsor(s) : University.  
 Investigator(s) : Pawar, R.E. and others.  
 Description : Preparation of koumiss from cow and buffalo milk was studied to assess the effect of milk source on the quality (including organoleptic) of the product. The blends used in the study were in the ratio (cow milk:buffalo milk) 25:75, 50:50 and 75:25. Koumiss prepared entirely from cow milk or buffalo milk was also studied. Buffalo milk contributed more towards acidity, ascorbic acid, alcohol content than cow milk. Panel of judges found buffalo milk koumiss superior in overall acceptability than cow kowmiss.  
 Report(s) : -  
 Papers Published : -
- 727 Project Title : Studies on the preparation of mixed starter in liquid and freeze dried form for the production of Koumiss.  
 Organisation : National Dairy Research Institute, Karnal 132 001; Dairy Bacteriology Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979-1981.  
 Sponsor(s) : ICAR  
 Investigator(s) : Tiwari, M.P. and others.  
 Description : Koumiss (100 batches) was prepared from skim milk diluted with 30 and 50% water using three strains of mesophilic and two of thermophilic bacteria to develop lactic acid and two yeasts (strain No.522 and Baker) to bring about alcoholic fermentation. The milk was fortified before fermentation with carbohydrates. Incubation was done in two stages, namely, first at 30 or 37 C for acid development and their at 18 C to develop alcohol. The lactic cultures uniformly developed acidity but there were differences in alcohol production. Satisfactory results were obtained with 30% diluted skim milk and fermentation with a mixed lactic culture and yeast. The Koumiss so prepared had approximately 1.1% acid (as lactic acid), 0.75% alcohol and ample quantities of gas and sweetening agents. Preliminary trials have also been conducted to prepare salted and sweetened flavoured Koumiss. Currently, trials with various combinations of cultures are underway to select the best. Semi pilot plant production of koumiss will also be conducted to study the performance of the selected culture combination and consumer preference for the product.  
 Report(s) : Annual  
 Papers Published : -
- 728 Project Title : Microbiology of indigenous milk products - Srikhand.  
 Organisation : National Dairy Research Institute, Karnal 132 001; Dairy bacteriology Department.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979-1981.  
 Sponsor(s) : ICAR

- Investigator(s) : Ghodekar, D.R.; Srinivasan, R.A.  
 Description : Shrikhand samples with desired acidity and flavour were inoculated with *S. aureus*-S<sub>6</sub> strain and tested after storage for development of the organisms at ambient temperatures. At low temperatures the organisms grew very slowly as compared to higher temperatures. Other characteristics of spoilage and the variations in counts of other toxigenic organisms were also studied. Shrikhand made with pure single starch cultures varied in task and flavour. Market mixed cultures gave lesser acidity but developed off flavours due to increase in number of yeasts during propagation of mixed cultures.
- Report(s) : Annual  
 Papers Published : -
- 729 Project title : Process alteration in Shrikhand technology.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979-1981  
 Sponsor(s) : ICAR  
 Investigator(s) : Patel, R.S.; Chakraborty, B.K.  
 Description : Shrikhand was prepared from buffalo skim milk using direct acidification technique but the product had grainy texture and lacked in flavour. Hence alternate sources of milk solids and different approaches of acidification were tried to improve the body and texture of Shrikhand. It was observed that acceptable quality of shrikhand could be prepared by conventional method from skim milk, reconstituted skim milk, and dilute condensed milk with 10% T.S.
- Report(s) : Annual  
 Papers Published : -
- 730 Project Title : Nutritional evaluation of shrikhand.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1982-1983.  
 Sponsor(s) : ICAR  
 Investigator(s) : Atreja, S.K.; Deodhar, A.D.  
 Description : The changes in nutritional quality of proteins and vitamin contents in Shrikhand are being studied.
- Report(s) : Annual.  
 Papers Published : -
- 731 Project Title : Utilization of ripened cream butter milk for the manufacture of various milk products.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980.  
 Sponsor(s) : ICAR  
 Investigator(s) : Tiwari, B.D. and others.  
 Description : The buttermilk containing 8.4% total solids and 0.40% acidity was heated to 80 C for 5 min and used for manufacture of three batches each of chhana and Paneer using 1% solution of lactic acid and citric acid as coagulant. The body and texture of chhana prepared using lactic acid was softer than that of citric acid. The citric acid coagulant appears to be superior as far as body and texture of paneer are concerned. The pH coagulation in both the cases was 5.4.



Report(s) : Annual  
 Papers Published : -

732 Project Title : Utilisation of sweet cream butter milk in the market industry.  
 Organisation : National Dairy Research Institute, Karnal 132 001; Dairy Technology Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1975-1981.  
 Sponsor(s) : ICAR  
 Investigator(s) : Dharam Pal; Mulay, C.A.  
 Description : The possibilities of utilising butter milk as milk extender are being explored. Whole buffalo milk extended with sweet cream butter milk, in liquid as well as dried forms to contain 3.0% fat and 8.5% SNF, and 1.5% fat and 9.0% were prepared and studied for keeping quality and acceptability. The milk are also being studied for effects of different types of processing like pasteurisation, homogenisation, heating, boiling, and sterilisation (in bottle).

Report(s) : Annual report.  
 Papers Published : 1. Vijay Kumar and Mulay, C.A. Processing and utilisation of sour milk. Indian Dairyman. 31(6); 1979; 391.

### Yoghurt

733 Project Title : Study of yoghurt starters in buffalo milk.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1978-1981.  
 Sponsor(s) : ICAR  
 Investigator(s) : Jasjit Singh and others.  
 Description : The activity of pure and mixed cultures of *S. thermophilus* and *S. bulgaricus* as yoghurt starters in buffalo milk was tested. The mixed cultures gave greater acid production due to enhanced growth of streptococcus. The viable thermophilus counts at 8 hours in cow milk and 4 hours in buffalo milk was significantly increased and later the viable count decreased. This was attributed to pH effect. Again, growth of *L. bulgaricus* in mixed culture was less vigorous than in controls in both milks. The inhibition was attributed to crowding, suboptimal pH, competition was nutrients and presence of inhibitory compounds. The effect of the variations in fat and SNF ratios of buffalo milk on the activity of the starter was also studied keeping cow milk as the standard.

Report(s) : Annual  
 Papers Published : -

### Paneer

734 Project Title : Studies on certain aspects of technology of paneer.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981-1983.  
 Sponsor(s) : ICAR  
 Investigator(s) : Singh, S.; Kanawjia, S.K.  
 Description : Paneer was made from standardised buffalo milk with different percentages of fat and compared with skim milk paneer. Addi-

tives used were sodium citrate (0.1, 0.2%), sodium chloride (0.5, 1%) sodium carbonate (0.1%), ammonium carbonate (0.05%) and carboxymethyl cellulose (0.05%). The process modification involved homogenisation of whole milk and skim milks, blending them with unhomogenised cream and varying coagulation temperatures. Standardised milk was also fortified with spray dried skim milk to solids content in paneer. Efforts were made to increase shelf life by dipping in plain water, 5% brine and acidified water (pH 5.0) before packing in polyethylene sachets. The paneer thus made was acceptable after 24 hours storage at 10 C.

Report(s) : Annual  
Papers Published : -

735 Project Title : Large scale trials for the manufacture of paneer.  
Organisation : Central Food Technological Research Institute, Mysore-570013; Process Design and Development Discipline.  
Project Category : Applied.  
Cost : Rs. 31,000/-.  
Duration : August 1980-April 1981  
Sponsor(s) : Institute.  
Investigator(s) : Krishnaiah, M.M. and others.  
Description : Project engineering details for production of Paneer (containing groundnut flour) was streamlined. Particle size had no significant effect on the process. Good homogenisation was required for minimising fat and solid losses in the whey, and autoclaving of the final product as compared to frying, seemed beneficial. The product, on evolution for consumer acceptance, was found comparable with the commercial paneer made with whole milk in terms of its appearance, texture, aroma, mouth-feel and other qualities. Further consumer acceptance studies are in progress.

Report(s) : Annual  
Papers Published : -

#### Butter and Butter fat

736 Project Title : Detection of adulteration in butter fat.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1976-1987  
Sponsor(s) : ICAR  
Investigator(s) : Singhal, O.P.  
Description : The project aims to study the foreign fats added to butter fat and also the possibilities of evolving a simple test for the simultaneous detection of the foreign fats. Digitonides prepared from ghee, body fats and adulterated ghee samples were first analysed by TLC, The digitonides of pure ghee showed one spot on TLC plate, whereas adulterated ghee samples showed two spots with streaking inbetween the spots. This method can detect vegetable oils in ghee at 10% level and above. It was also observed that this method could be applied to detect body fats at 10% level and above.

Report(s) : Annual  
Papers Published : 1. Singhal, O.P. Adulterants and methods for detection. Indian Dairyman. 32(10); 1981; 771



- 737 Project Title : Studies on rheological characteristics of butter as influenced by processing conditions.  
 Organisation : National Dairy Research Institute, Southern Regional Station, Audugodi, Bangalore.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-1982  
 Sponsor(s) : ICAR  
 Investigator(s) : Kulkarni, S.S.; Rama Murthy, M.K.  
 Description : Effect of ripening, salting moisture and SNF was studied. Objective studies showed acidity of cream resulted in significant variation in rheological parameters but salting did not except in the case of oiling off property. In subjective tests, it was observed that acidity caused significant variation in hardness and spreadability but did not result in any significant variation in stickiness. Salting caused significant effect on all rheological parameters except on stickiness score. SNF had also effect on all parameters except extruder friction and hardness score.  
 Report(s) : Annual.  
 Papers Published : -
- 738 Project Title : Technological studies on the manufacture of butter powder from buffalo milk.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979-1981.  
 Sponsor(s) : ICAR  
 Investigator(s) : Sitaram Prasad; Gupta, S.K.  
 Description : The various processing parameters for the manufacture of butter powder from buffalo milk on the basis of its physico-chemical properties and sensory evaluation are studied. The effect of addition of fractionated butter fat on the quality of buffalo milk butter powder is also studied.  
 Report(s) : Annual.  
 Papers Published : 1. Prasad, S.R. and Gupta, S.K. Butter powder - a high fat dairy product for tropics. Indian Dairyman. 31; 1979; 11
- 739 Project Title : Physico-chemical constants of ghee prepared from Desi cross bred and Surbi buffalo milk.  
 Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani 431 402; Department of Dairy Technology  
 Project Category : Fundamental and applied.  
 Cost : Rs. 15,000/-.  
 Duration : March 1980-July 1982  
 Sponsor(s) : University and Government of Maharashtra,  
 Investigator(s) : Rathi, S.D.  
 Description : The project is concerned with fixing standards for physico-chemical constants for ghee for Marathwada region.  
 Report(s) : -  
 Papers Published : -
- 740 Project Title : Standardisation of industrial practices for manufacturing ghee.  
 Organisation : Andhra Pradesh Dairy Development Co-operative Federation Limited, Lalpet, Hyderabad 500 789.

Project Category : Survey.  
 Cost : Rs. 2,62,950/-.  
 Duration : March 1979-March 1982.  
 Sponsor(s) : ICAR  
 Investigator(s) : Jain, M.K. and others.  
 Description : Objectives of the project are: (a) to establish regional standards based on sensory evaluation techniques, (b) to study the effect of various manufacturing techniques on the final quality, shelf life and recovery of ghee and to investigate the methods of attaining the regional standards of quality, and (c) to implement the evolved processing practices under industrial situations.

Report(s) : -

Papers Published : -

\*575

741 Project Title : Studies on lactone profile . of ghee.  
 Organisation : National Dairy Research Ins itute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-1982.  
 Sponsor(s) : ICAR  
 Investigator(s) : Wadhwa, B.K.; Jani, M.K.  
 Description : The project investigates to obtain basic information about the lactonic components of ghee in order to prepare improved milk fat products. A column chromatographic method was standardized for the isolation of lactones from ghee samples. The extracted material was subjected to preparative TLC on silica gel G plates.

Report(s) : Annual

Papers Published : -

742 Project Title : Chemical changes in ghee during deep fat frying of foods.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1978-1981.  
 Sponsor(s) : ICAR  
 Investigator(s) : Rai, T.; Narayanan, K.M.  
 Description : The changes taking place in ghee and a standard vegetable oil during deep fat frying of foods in iron Karahi in comparison with similar study with aluminium Karahi were studied. The samples were analysed for fat contents, peroxide value, TBA value, free fatty acids, epoxide value, carbonyls and poly unsaturated fatty acids.

Report(s) : Final.

Papers Published : -

743 Project Title : A comparative study on the determination of oxidative rancidity in ghee by different methods.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981-1983  
 Sponsor(s) : ICAR  
 Investigator(s) : Bector, B.S.  
 Description : Cow and buffalo ghee samples prepared by creamery-butter method were stored in glass bottles at 37 C in an incubator. The fresh ghee was analysed for peroxide value (iodometric and colorimetric), TBA value, saturated and unsaturated



carbonyls and FFA content. They did not show any PV by iodometric method but by colorimetric method PV was significant. TBA value, FFA and saturated carbonyls of fresh cow and buffalo ghee were respectively 27-33, 0.017-0.36% and 4.0-4.8 millimoles/kg. The unsaturated carbonyls varied from 0.2-0.5 millimoles/kg of ghee.

Report(s) : Annual  
Papers Published : -

744 Project Title : Effect of different levels of moisture on the shelf life of ghee.

Organisation : National Dairy Research Institute, Karnal 132 001.

Project Category : Applied.

Cost : -

Duration : 1980-1981.

Sponsor(s) : Indian Council of Agricultural Research.

Investigator(s) : Sharma, U.P.; Rajorhia, G.S.

Description : The project aims to study the effects of different levels of moisture on the chemical quality of ghee on storage in tin containers. Samples of ghee containing various moisture levels were stored in tin containers at 30 C. They were opened at monthly intervals covering a period of six months and examined for refractive index at 40 C, acidity (oleic), R.M. value, polensky value, vitamin A content and contamination of copper and iron.

Report(s) : Annual report.

Papers Published : -

745 Project Title : Comparative merits of different polythene film materials with regard to keeping quality and grain structure of ghee.

Organisation : National Dairy Research Station, Audugodi, Bangalore.

Project Category : Applied.

Cost : -

Duration : 1981-1982.

Sponsor(s) : ICAR

Investigator(s) : Pantulu, P.C. and others.

Description : Several packaging materials were tried in the storage trials. It was possible to preserve grain structure in metallised polyester pouches within certain variation in temperature during storage. Development of peroxide and FFA were slightly higher in ghee stored in glass bottles than in pouches both at temperatures of 37 C and 60 C. The overall conclusion was that the keeping quality of ghee packed in metallised pouches was slightly better than that stored in glass bottles.

Report(s) : Annual.

Papers Published : -

746 Project Title : Effect of metal containers on the keeping quality of ghee.

Organisation : National Dairy Research Institute, Southern Regional Station, Audugodi.

Project Category : Applied.

Cost : -

Duration : 1981-1982

Sponsor(s) : ICAR

Investigator(s) : Unnikrishnan, V.; Rama Murthy, M.K.

Description : In tin containers, the influence of high levels of moisture and acidity on the keeping quality of ghee was more marked. Lacquering, though protecting from moisture and acid initially, could not protect the quality of ghee for longer periods.

- Report(s) : Annual.  
Papers Published : -
- 747 Project Title : Nutritional evaluation of casein and ghee prepared from sour/curdled milk.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1980-1981.  
Sponsor(s) : ICAR  
Investigator(s) : Kansal, V.K. and others.  
Description : The safety of casein and ghee was determined and nutritional quality of casein prepared from sour/curdled milk were evaluated. Growth of different groups of microorganisms (total counts, coliforms, enterococci, total micrococci, Staphylococcus aureus, Salmonella and Shigella, anaerobic spore formers and yeasts and molds) were studied in raw milk soured to 0.2, 0.3 and 0.4% acidities. The growths of all groups of bacteria slowed down with the increase in acidity. Casein was prepared from milk soured to 0.2, 0.3, 0.4 percent acidities. No pathogenic organisms and coliform were detected from any batch of casein.  
Report(s) : Annual.  
Papers Published : -
- 748 Project Title : Utilisation of curdled milk for ghee making.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1979-1981.  
Sponsor(s) : ICAR  
Investigator(s) : Vijaykumar, K.L. and others.  
Description : The project intends to study the feasibility of maximum fat recovery from curdled milk by various methods such as direct churning of curdled milk and reprocessing of neutralized milk. The effect of preparing ghee by these techniques on its sensory, analytical and keeping quality characteristics are also studied.  
Report(s) : Annual.  
Papers Published : 1. Vijay Kumar, K.L. and Mulay, C.A. Processing and utilisation of sour milk. Indian Dairyman 31(6); 1979; 391
- 749 Project Title : Standardisation of industrial practices for manufacturing ghee.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1979-1981  
Sponsor(s) : ICAR  
Investigator(s) : Narayanan, K.M. and others.  
Description : The project intends to establish regional standards for ghee based on sensory evaluation and to study the effect of various ghee manufacturing techniques on the attainment of regional standards, as well as on keeping quality. The effectiveness of three-ply laminates of polyethylene/aluminium/paper for packaging and storage of ghee are also being investigated.  
Report(s) : Annual  
Papers Published : -



- 750 Project Title : Comparative studies on butter oil, flavour induced butter oil and ghee.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-.  
 Sponsor(s) : ICAR  
 Investigator(s) : Bindal, M.P.; Wadhwa, B.K.  
 Description : A new simple method has been devised to isolate free fatty acids (FFA) from milk fat (ghee) based on the absorption of FFA by alumina. Different grades of aluminium oxide (BDH) were examined to find out their efficiency in the isolation of FFA. It was observed that the basic alumina proved to be a very strong adsorbent of FFA from ghee, while the neutral aluminium oxide was not.  
 Report(s) : Annual.  
 Papers Published : -
- 751 Project Title : Origin of flavour in ghee prepared by different methods.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1975-  
 Sponsor(s) : Institute.  
 Investigator(s) : Wadhwa, B.K. and others.  
 \*576
- 752 Project Title : Isolation and characterisation of lactonic flavour components in ghee.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1974-.  
 Sponsor(s) : Institute.  
 Investigator(s) : Wadhwa, B.K.; Jain, M.K.  
 \*577
- 753 Project Title : Production of phospholipids from microorganisms and from other sources and their utilisation for increasing the shelf life of ghee.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1973-.  
 Sponsor(s) : Institute.  
 Investigator(s) : Srinivasan, R.A.; Ratan Chand.  
 \*578
- 754 Project Title : Characterisation of polymers in ghee.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Fundamental and Applied.  
 Cost : -  
 Duration : 1975-.  
 Sponsor(s) : Institute.  
 Investigator(s) : Bector, B.S.; Narayanan, K.M.  
 \*580

- 755 Project Title : Assessment of Nutritional merits of ghee residue.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost :  
 Duration : 1980.  
 Sponsor(s) : ICAR  
 Investigator(s) : Ghosh, S.N.  
 Description : Two types of ghee residues (creamery butter and direct cream) were analysed for chemical composition. Feeding trials were also conducted to ascertain PER which was quite low. Lysine supplementation improved PER. B.V., D.C. and NPU values more or less followed similar pattern in relation to PER values. Lysine was therefore considered the only essential amino acid which drastically affected nutritive value of ghee residue. The ghee residue of direct cream gave some what lower values.  
 Report(s) : Annual.  
 Papers Published : -  
 \*581
- 756 Project Title : Identification of chemical constituents of ghee residue and their role on preservation of ghee.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1974-  
 Sponsor(s) : Institute.  
 Investigator(s) : Santha, I.M.; Narayanan, K.M.  
 \*582
- 757 Project Title : Role of starter bacteria and other organisms in improving the quality of ghee.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Abraham, M.J. and others.  
 Description : The performance of the four starter cultures, Streptococcus lactis C<sub>19</sub>, Streptococcus diacetylactis DRC, Streptococcus thermophilus HST and Streptococcus bulgaricus LBW were investigated in cow milk cream. S. lactis C<sub>19</sub> and S. diacetylactis DRC the developed flavour components and antioxidant substances during their growth and proliferation in the cream which in turn contributed to improvement of flavour and keeping quality of ghee. The other two strains had no positive influence.  
 Report(s) : Annual.  
 Papers Published : 1. Abraham, M.J. and Srinivasan, R.A. Effect of ripening cream with selected acid bacteria on the quality of ghee. J. Dairy Res. 47; 1980; 411.

### Cheese and Whey

- 758 Project Title : Production of beverage from Chakka whey.  
 Organisation : Punjabrao Krishi Vidyapeeth, Akola 444 104; Department of Animal Husbandry and Dairying.



- Project Category : Applied.  
 Cost : -  
 Duration : December 1981-April 1982.  
 Sponsor(s) : Vidyapeeth.  
 Investigator(s) : Pande, S.P. and others.  
 Description : The procedure for production of a beverage from chakka whey will be standardised. One culture of lactic acid bacteria along with one culture of yeast is being tried for producing the beverage.  
 Report(s) : -  
 Papers Published : -
- 759 Project Title : Studies on the preparation of Swiss type cheese.  
 Organisation : National Dairy Research Institute; Southern Regional Station, Aduodi, Bangalore 560 030.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1973-  
 Sponsor(s) : Institute.  
 Investigator(s) : Thomas, S.P. and others.  
 \*589
- 760 Project Title : Manufacturing techniques for cheddar type cheese from cow milk using microbial rennet.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979-1981.  
 Sponsor(s) : ICAR  
 Investigator(s) : Tiwari, B.D.; Chakraborty, B.K.  
 Description : A method was standardised using rennets obtained from *B. subtilis* K-26 and *Abisidia ramosa*. The product lacked characteristic flavour, body and texture. Among modifications for improvements tried, reduction of the quantity of enzyme gave a better product.  
 Report(s) : Annual.  
 Papers Published : -
- 761 Project Title : Cheddar cheese manufacture using Rhizopus oligosporus protease.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Microbiology and Fermentation Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,73,700/-.  
 Duration : April 1979-March 1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Krishna Nand; and others.  
 Description : R. oligosporus protease was passed through columns imported resin for bulk production of the modified enzyme. The enzyme recovery ranged from 70 to 80 per cent. Ratio of milk to proteolytic activity ranged from 5.7 to 9.5. Removal of the polysaccharides and other impurities that intervene with the solvent precipitation of crude enzyme by pretreating with calcium phosphate gel was done. An indigenous resin, was tested and found suitable for substituting the imported resins. About 600 litres of mouldy bran concentrate having activity of 10,000-13,000 Soxhlet units/ml were produced in the pilot plant. Cheddar cheese manufactured with the modified enzyme rated higher in quality as compared to that prepared by using microbial rennets, and was similar

to that of calf rennets and Rennilase cheese.

Report(s)

Papers Published

1. Krishna Nand and others. Comparison of the yield and quality of cheese made with calf rennet and treated enzyme preparation of Rhizopus oligosporus as coagulants. Die Nahrung. 24(9); 1980; 859
2. Krishna Nand and others. Effect of heat and alumina production on the protease of Rhizopus oligosporus. Indian J. Exp. Biol. 18(7); 1980; 761.

762 Project Title : Utilisation of fungal proteases for the manufacture of cheese and related products.

Organisation : Central Food Technological Research Institute, Mysore-570013; Microbiology and Fermentation Technology Discipline.

Project Category : Applied.

Cost : Rs. 4,40,000/-.

Duration : April 1980-March 1983.

Sponsor(s) : Institute.

Investigator(s) : Krishna Nand and others.

Description : An acceptable cheddar cheese was produced using fractionated enzyme of Rhizopus oligosporus. Conditions for separation of protease from the organism were standardised using a big column of indigenous cationic resin substituting for Amberlite IRC-50. The enzyme production process was also sealed up. The cheese had chemical and organoleptic qualities similar to that prepared with calf rennet. A method of preparing a good quality curd using this enzyme was also developed as also a new product named 'curd candy' which is nutritious tasty and may find popularity with children.

Report(s)

Papers Published

- : -
1. Krishna Nand and others. Effect of heat and alumina adsorption on the protease of Rhizopus oligosporus. Indian J. Expt. Biol. 18(7); 1980; 761
  2. Krishna Nand and others. Comparison of the yield and quality of cheese made with calf-rennet and treated enzyme preparation of Rhizopus oligosporus as coagulants. Die Nahrung. 24(9); 1980; 859

763 Project Title : Technological Studies on bitterness in cheddar cheese from buffalo milk.

Organisation : National Dairy Research Institute, Karnal 132 001.

Project Category : Applied.

Cost : -

Duration : 1980-

Sponsor(s) : ICAR

Investigator(s) : Waghmare, W.M.; Gupta, S.K.

Description : Three batches of cheddar cheese were tasted for bitterness by sensory evaluation. The statistical analysis of the sensory scores of buffalo milk cheddar cheese revealed that there was no significant difference between the methods of manufacture. The effect of mixing cow milk cheese with buffalo milk cheese was also studied. Results showed that 90 parts of buffalo milk solids (fresh milk) with 10 parts of cow skim milk solids (SMP) produced desirable quality cheese.

Report(s)

Papers Published

: Annual.

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- 764 Project Title : Preparation of non-bitter cheddar cheese using single and combined starter cultures.
- Organisation : National Dairy Research Institute, Regional Station (Southern) Audugodi, Bangalore.
- Project Category : -
- Cost : -
- Duration : 1981-
- Sponsor(s) : ICAR
- Investigator(s) : Natarajan, A.M. and others.
- Description : Efforts are being made to prepare non-bitter cheese by modifying the cheese making procedures. It was found higher concentration of rennet produced more bitterness. Bitter and non-bitter strains of starter cultures were identified and used in pairs to eliminate bitterness. The combinations found suitable were *S. cremoris* and *S. lactis*, and *S. thermophilus* and *S. lactis*. In general, increase in cooking temperature postponed the development of bitterness.
- Report(s) : Annual.
- Papers Published : -
- 765 Project Title : Studies on changes in protein fraction during ripening of Gouda cheese prepared from standardised buffalo, and cow milks and their impact on flavour development.
- Organisation : National Dairy Research Institute, Southern Regional Station, Audugodi, Bangalore.
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : ICAR
- Investigator(s) : Joshi, V.K. and others.
- Description : Two samples of Gouda cheese prepared from composite milk using respectively *Streptococcus lactis* and *S. lactis* + *S. cremoris* were evaluated for pH, water-soluble protein, protease, proteose-peptone, non-protein nitrogen at 15, 30, 45 and 60 days of ripening. Both samples recorded slight development of cheese-like flavour; the intensity was more in sample prepared with combination of *S. lactis* and *S. cremoris*. Both samples also recorded increase in the level of water-soluble protein, protease, proteose-peptone and non-protein nitrogen with the ripening period. The pH also increased and was found to be in the range of 4.9 to 5.4. The samples are further being examined at different periods of ripening. Work will also be taken up to study the samples at various ripening stages for electrophoretic, gel filtration and free amino acid patterns. Studies will also be made to compare the cow milk cheese with buffalo milk cheese.
- Reports : Annual report.
- Papers Published : -
- 766 Project Title : Preservation of cheese by combined use of gamma-rays and sorbic acid.
- Organisation : Bhabha Atomic Research Centre, Bombay 470 085.
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : Centre.
- Investigator(s) : Bongirwar, D.R.; Kumta, U.S.
- Description : -

## Reports

## Papers Published

1. Bongirwar, D.R. and Kumta, U.S. Preservation of cheese by combined use of gamma rays and sorbic acid. International Journal of Applied Radiation and Isotopes. 18, 1967, 133.

- 767 Project Title : Development of cheese and cheese-like fermented products from soybean.  
 Organisation : Govind Ballabh Pant University of agriculture and Technology, Pantnagar 263 145; Food Science and Technology Department.  
 Project Category : Applied.  
 Cost : Rs. 4,03,000/-.  
 Duration : November 1976-1981.  
 Sponsor(s) : Institute.  
 Investigator(s) : Shivashraya Singh; Mittal, S.K.  
 \*589
- 768 Project Title : Study on micrococcal lipases.  
 Organisation : National Dairy Research Institute, Karnal 132 001, Dairy Bacteriology Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Malik, R.K. and others.  
 Description : Ninety selected micrococcal isolates from cheddar cheese were screened for lypolytic potential and 68 were found positive for lipase activity. These isolates were further screened for quantitative lipase activity titrimetrically for selection a promising isolate with comparatively higher lipase activity. Detection of intra- and extra- cellular lipase activity was also tried using this substrate at different pH but reproducible results could not be obtained. The project, was therefore terminated.  
 Report(s) : Annual report.  
 Papers Published : -
- 769 Project Title : Studies on the use of bacterial rennet for cheddar cheese manufacture.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1976-  
 Sponsor(s) : Institute.  
 Investigator(s) : Tiwari, B.D. and others.  
 \*591
- 770 Project Title : Standardisation of method of gouda cheese manufacture from buffalo milk.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977-1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Gogoi, H.K.; Mulay, C.A.  
 \*594
- 771 Project Title : Utilization of cheese whey in enhancing the nutritive value of Indian diet.  
 Organisation : National Dairy Research Institute, Karnal 132 001.



- Project Category : Applied.  
 Cost : -  
 Duration : 1980  
 Sponsor(s) : ICAR  
 Investigator(s) : Rao, R.V.; Balasubramanya, N.N.  
 Description : Experiments on the supplementation of cheese whey to the ragi diet are being carried out. Ragi diet at 4% level protein using casein was used as the standard. In the case of ragi diet, two types of diets were prepared. One type consisted of ragi balls prepared using ragi flour and dialysed cheese whey and the other using ragi flour and water. Studies are under way on 36 young albino rats for the determination of PER, NPV and NPR. The cheese whey supplementation was comparable or slightly superior to casein. Irrespective of protein source, 10% levels of protein was found superior to either 5 or 15%.
- Report(s) : Annual.  
 Papers Published : -  
 \*595
- 772 Project Title : Role of the starter cultures in the preparation and ripening of various cheeses.  
 Organisation : National Dairy Research Institute, Southern Regional Station, Audugodi, Bangalore.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981-1983.  
 Sponsor(s) : ICAR  
 Investigator(s) : Natarajan, A.M.; Ranganathan, B.  
 Description : Cheddar cheese was manufactured from poor quality market milk and its bacteriological quality studied. It was possible to prepare acceptable cheese by judicious selection of starter cultures and marginal modification of the manufacturing technique.
- Report(s) : Annual.  
 Papers Published : -
- 773 Project Title : Utilisation of vegetable proteases for cheese manufacture.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981-1983.  
 Sponsor(s) : ICAR  
 Investigator(s) : Gupta, S.K.; Bhatia, K.L.  
 Description : The project is concerned with separation and concentration of milk clotting activities of papain, ficin and extract of W. coagulans. Changes in cheese made from the isolated milk clotting components, either alone or in combination with rennet extract will also be studied.
- Report(s) : Annual.  
 Papers Published : -
- 774 Project Title : Studies on accelerated ripening of cheese.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981-1983.  
 Sponsor(s) : ICAR

- Investigator(s) : Singh, S.; Kanawjia, S.K.  
 Description : The project is concerned with the scaling up of accelerated ripening of cheddar curd slurries for production of cheese spread, processed cheese and cheese powder, and utilisation of direct acidified curd for production of cheese and cheese type products.  
 Report(s) : Annual.  
 Papers Published : -
- 775 Project Title : Manufacture of high protein beverage from soybean and whey.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-  
 Sponsor(s) : ICAR  
 Investigator(s) : Patil, G.R.; Gupta, S.K.  
 Description : The combination of soybean in the form of (i) blanched, dehulled cotyledons (ii) soy-protein lipid concentrate with cheese whey as (i) condensed whey and (ii) lactose reduced condensed whey were studied keeping in view the sensory quality and viscosity measurements of the resulting beverage.  
 Report(s) : Annual  
 Papers Published : -
- 776 Project Title : Studies on the preparation of vinegar from whey.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Gandhi, D.N.; Verma, B.B.  
 Description : Acetic acid bacteria were isolated from whey wine, apple and whey as enrichment media and allowed for spontaneous fermentation at 30 C for one week. These were compared with standard strains. Few isolates from whey wine and apple were selected for further purification and characterisation which are underway. Trials on production of vinegar from whey wine were also conducted using cultures of *Saccharomyces cerevisiae* for fermentation. The effect of aeration on the rapid production of vinegar was also studied.  
 Report(s) : Annual report.  
 Papers Published : -
- 777 Project Title : Whey protein concentrate as a supplement for staple foods.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-1982.  
 Sponsor(s) : ICAR  
 Investigator(s) : Manjusha Kapoor; Deodhar, A.D.  
 Description : The effect of supplementation of cereals, certain millets and legumes with whey protein concentrate (WPC) on the nutritive value of their protein, is assessed. The effect of such supplementation on the chapati/roti making qualities of wheat/jowar flour and the biological availability of certain essential aminoacids in chapati are assessed.  
 Report(s) : Annual.  
 Papers Published : -



- 778 Project Title : Studies on the technique of production, packaging and shelf life of dried whey.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1972-  
 Sponsor(s) : Institute.  
 Investigator(s) : Bhanumurthy, J.L. and others.  
 \*584
- 779 Project Title : Studies on cheese making using lipolytic strains of lactic acid bacteria.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1976-  
 Sponsor(s) : Institute.  
 Investigator(s) : Harish Chander; Ranganathan, B.  
 \*585
- 780 Project Title : Studies on the purification and characterisation of a caseinolytic enzyme isolated from micrococci of cheddar cheese origin.  
 Organisation : National Dairy Research Institute, Karnal 132 001; Dairy Bacteriology Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977-1980.  
 Sponsor(s) : ICAR  
 Investigator(s) : Rajendra Prasad; Mathur, D.K.  
 Description : On the basis of extensive screening, the isolate *Micrococcus* sp. A CC-315 was selected due to its comparatively higher caseinolytic activity. Using this isolate, production of caseinolytic enzyme was studied in regard to optimisation of production parameters, relationship between growth and enzyme production and distribution pattern of the enzyme. Based on the fact that EDTA completely inhibited the enzyme and that Ca is required for maintenance of active conformation of the enzyme, the caseinolytic enzyme of *Micrococcus* Sp. MCC-315 was classified as calcium metallo enzyme.  
 Report(s) : Annual.  
 Papers Published : -  
 \*586
- 781 Project Title : Studies on the production of emmenthaler type (eye-hole) cheese from buffalo milk.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1974-  
 Sponsor(s) : Institute.  
 Investigator(s) : Ladkani, B.G.; Srinivasan, M.R.  
 \*587

## Khoa

- 782 Project Title : Survey on production and utilisation of khoa in Marathwada region.
- Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani 431 402; Department of Dairy Technology.
- Project Category : Applied and Survey.
- Cost : Rs. 21,000/-.
- Duration : October 1980-March 1983.
- Sponsor(s) : University and Government of Maharashtra.
- Investigator(s) : Rathi, S.D.; Joglekar, N.V.
- Description : Various milk shed areas of Marathwada region will be surveyed to assess the production and utilisation of khoa in this region. The survey is also concerned with assessment of the quality of khoa marketed and knowing the different sweets prepared by using khoa, khoa content (%) of different sweets as well as their chemical quality.
- Report(s) : -
- Papers Published : -
- 783 Project Title : Studies on production, packaging and preservation of indigenous milk products.
- Organisation : National Dairy Research Institute, Karnal 132 001.
- Project Category : Applied.
- Cost : -
- Duration : 1978-
- Sponsor(s) : ICAR
- Investigator(s) : Rajorhia, G.S.
- Description : The mechanical process of manufacturing khoa with a preheating cylinder and the caccading pans; the utilization of dried milks for khoa making; the use of pre-concentrated milk for khoa; the adoption of roller drying process for khoa making; increasing the shelf life of khoa; utilization of concentrated and dried milks for chhana making; improvements in the shelf life of ghee; formulating suitable quality standards for paneer; and evolving large scale methods of manufacturing Burfi, are investigated.
- Report(s) : Annual.
- Papers Published : 1. Rajorhia, G.S. and Srinivasan, M.R. Technology of Khoa; A review. Indian J. Dairy Sci. 32(3); 1979; 209
- 784 Project Title : Some aspects of nutritive value of khoa.
- Organisation : National Dairy Research Institute, Karnal 132 001.
- Project Category : Applied.
- Cost : -
- Duration : 1976-1982.
- Sponsor(s) : ICAR
- Investigator(s) : Manisha Sapre; Deodhar, A.D.
- Description : The project aims to evaluate protein quality of standardised milk (5% fat), pasteurised dhap (the stage at which the product assumes consistency and detach from the sides of the bottle), and khoa (35% moisture) by measuring modified PER using protein depleted rats. Vitamin retention studies were also conducted.
- Report(s) : Annual.
- Papers Published : -
- 785 Project Title : Studies on the role of Staphylococci as a potential producer of enterotoxins in khoa.
- Organisation : National Dairy Research Institute, Southern Regional Station, Bangalore.



Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Varadaraj, M.C. and others.  
 Description : Production of enterotoxins inoculated in raw cow milk and khoa made of it are being studied. Toxicity of these enterotoxins are also being tested in rabbits. Toxins will also be characterised.  
 Report(s) : Annual.  
 Papers Published : 1. Varadaraj, M.C. and Nambudripad, V.K.N. Staphylococcal incidence in market khoa and their enterotoxins production. J. Food Sci. Technol. 19; 1982; 55.

## Icecream

- 786 Project Title : Study of soft serve ice-cream blended with mango pulp  
 Organisation : Punjabrao Krishi Vidyapeeth, Akola 444 104; Department of Animal Husbandry and Dairying.  
 Project Category : Applied.  
 Cost : -  
 Duration : January 1981-June 1981.  
 Sponsor(s) : Vidyapeeth.  
 Investigator(s) : Tambat, R.V. and others.  
 Description : Effect of different levels of mango pulp, viz. 0, 5, 10, 15 and 20%, was studied in the soft serve ice cream. Physico-chemical properties of the ice cream mix, ice cream and acceptability of ice cream were also studied.  
 Report(s) : -  
 Papers Published : -
- 787 Project Title : Study of soft serve ice-cream blended with orange juice.  
 Organisation : Punjabrao Krishi Vidyapeeth, Akola 444 104; Department of Animal Husbandry and Dairying.  
 Project Category : Applied.  
 Cost : -  
 Duration : February 1980-June 1980.  
 Sponsor(s) : Vidyapeeth.  
 Investigator(s) : Tambat, R.V. and others.  
 Description : Effect of different levels of orange juice, viz. 0, 5, 10, 15 and 20% was studied in the soft serve ice-cream. Physico-chemical properties of mix and icecream and the acceptability of ice-cream were also studied.  
 Report(s) : -  
 Papers Published : -
- 788 Project Title : Studies on low cost ice cream.  
 Organisation : National Dairy Research Institute; Southern Regional Station, Aduodi, Bangalore 560 030.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1975-  
 Sponsor(s) : Institute.  
 Investigator(s) : Rao, R.V. and others.  
 \*597
- 789 Project Title : Possibility of utilisation of high-acid rejected milk for ice cream manufacture.

- Organisation : Mahatma Phule Agricultural University, Rahuri, Dist. Ahmednagar, Maharashtra; Department of Food Science and Technology.  
 Project Category : Applied.  
 Cost : Rs. 25,000/-.  
 Duration : June 1980-June 1984.  
 Sponsor(s) : Government of Maharashtra and ICAR.  
 Investigator(s) : Kulkarni, M.B.; Bethe, N.D.  
 Description : Efforts are being made to develop suitable technology to utilise high-acid rejected mills for manufacture of acceptable ice cream. Various manufacturing steps are being standardised to make the process practicable.  
 Report(s) : -  
 Papers Published : -
- 790 Project Title : Study of quality of ice cream in Bangalore market.  
 Organisation : University of Agricultural Sciencies; G.K.V.K.Campus, Bangalore 560 065; Animal Nutrition Department.  
 Project Category : Applied.  
 Cost : Rs. 1,60,000/-.  
 Duration : 1978-  
 Sponsor(s) : University.  
 Investigator(s) : Ramanjua Iyengar.  
 \*598
- 791 Project Title : Studies on the method of production and shelf life of dried cream from buffalo milk.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1974-  
 Sponsor(s) : Institute.  
 Investigator(s) : Sharma, S.P.; Mulay, C.A.  
 \*600
- 792 Project Title : Technological studies on the utilisation of butter milk and soybean for the manufacture of softy ice cream.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1974-  
 Sponsor(s) : Institute.  
 Investigator(s) : Rajor, R.B.; Gupta, S.K.  
 \*601
- 793 Project Title : Production of genetic variants of lactic acid bacteria.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Fundamental and Applied.  
 Cost : -  
 Duration : 1973-  
 Sponsor(s) : Institute.  
 Investigator(s) : Ranganathan, B. and others.  
 \*604
- 794 Project Title : Effect of heat and lactic acid production on the inactivation of staphylococcal enterotoxins.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977-1979.



Sponsor(s) : Institute.  
 Investigator(s) : Singh, R.S.:Ghodekar, D.R.  
 \*606

- 795 Project Title : Relationship between softening point, melting point and glyceride structure of goat milk fat.  
 Organisation : National Dairy Research Institute, Karnal.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981-1984.  
 Sponsor(s) : ICAR  
 Investigator(s) : Bindal, M.P.  
 Description : Six composite samples of goat and cow milk and ghee were prepared for analysis. As softening point apparatus, lab amalgamator and gas liquid chromatograph was not available the fat samples were used to standardise a method for colorimetric estimation of free fatty acid (FFA) in ghee. The method compared well with titrimetric methods of AOAC and ISI.  
 Report(s) : Annual  
 Papers Published : -
- 796 Project Title : Pilot plant production of bacterial rennet using a 10 litre fermentor.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1970-continuing.  
 Sponsor(s) : ICAR  
 Investigator(s) : Mathur, D.K. and others.  
 Description : Optimum conditions for production of bacterial rennet are being studied and methods of isolation, concentration and distribution of the enzyme are being standardised. The use of such enzymes for cheese manufacture is also being studied.  
 Report(s) : Annual report.  
 Papers Published : 1. Rao, L.K. and Mathur, D.K. Assessment of purified bacterial milk clotting enzyme for *Bacillus subtilis* K-26 for cheddar cheese making. J. Dairy Sci. 62(3); 1979; 328  
 2. Rao, L.K. and Mathur, D.K. Purification and properties of milk clotting enzyme from *Bacillus subtilis* K.-26. Biotechnol. Bioeng. 21(4); 1979; 535.  
 3. Sastry, K.J. and Mathur, D.K. Studies on the milk clotting enzyme from *Bacillus megaterium* K-40.1. Effect of some nutrients on enzyme production. J. Food Sci. Technol. 16; 1979; 15.  
 4. Sastry, K.J. and Mathur, D.K. Studies on milk clotting enzyme from *Bacillus megaterium* K-40. 2. Effect of some environmental factors on enzyme production. J. Food Sci. Technol. 16; 1979; 19.  
 5. Sastry, K.J. and Mathur, Studies on milk clotting enzyme from *Bacillus megaterium* K-40. 3. Purification and characterisation of the enzyme. Paper presented at the 20th Annual Conference of Association of Microbiologists (India), held at Haryana Agricultural Universities, 1979.  
 6. Arora, G.K. and others. Studies on the degradation of casein and its fractions by bacterial milk clotting enzymes. Paper presented at the 20th Annual Conference of Association of Microbiologists (India) held at Haryana Agricultural University, 1979.

- 797 Project Title : Preparation of powder rennet from Abomasa of young buffalo calves.  
 Organisation : National Dairy Research Institute, Karnal 132 001;  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Sharma, U.P.; Mathur, M.P.  
 Description : The method is being standardised.  
 Report(s) : Annual  
 Papers Published : -
- 798 Project Title : Radioisotopic studies on the synthesis and secretion of rennin.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Fundamental and Applied.  
 Cost : -  
 Duration : 1980-  
 Sponsor(s) : ICAR  
 Investigator(s) : Angelo, I.A.  
 Description : Ion exchange chromatographic studies using DEAE cellulose and polyacrylamide disc electrophoresis of fistulated cow and buffalo rennets revealed the heterogenous nature of these rennets. The proteolysis of casein by these rennets were also studied to assess their influence on the quality of cheese. Proteolysis of cow and buffalo milk, and mixed milk by the above rennets, pepsin and trypsin were also studied to obtain information on possible manufacture of cheese using various milk proteases.  
 Report(s) : Annual.  
 Papers Published : 1. Angelo, I.A. An appraisal of rennets from fistulated cow and buffalo calves and goat kid and Hansen rennet through chromatography and electrophoresis. Milchwissenschaft. 36; 1981; 147.
- 799 Project Title : Development of phage resistant starter cultures.  
 Organisation : National Dairy Research Institute, Southern Regional Station, Audugodi, Bangalore.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Natarajan, A.M.; Nambudripad, V.K.N.  
 Description : Failure was observed on a few occasions in the activity of two starter cultures. *S. lactis* S<sub>1</sub>R and DRC, used in preparation of cheese and fermented milks. They were therefore screened for their lysis by bacteriophage but with negative results.  
 Report(s) : Annual report.  
 Papers Published : -
- 800 Project Title : Studies on the production of lactic starter concentrate.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1978-1981  
 Sponsor(s) : ICAR  
 Investigator(s) : Tiwari, M.P. and others.



- Description : A medium which could support rich growth of Streptococci was prepared after extensive studies. Apart from the seven lactic cultures, the medium supported the growth of other allied organisms e.g. *Saccharomyces cerevisiae*, *S. fragilis* and *Propionobacterium shermani*. Of the cryoprotective agents tried to preserve the concentrate in liquid nitrogen, peptone in skim milk gave best results in LF-40 cultures. The concentrate gave good results with preparation of Dahi and Lassi. It was found that 15 ml of the concentrate could curdle 150 litres of milk during overnight incubation at room temperature.
- Report(s) : Annual report.
- Papers Published : -
- 801 Project Title : Utilisation of mutants of lactic starter cultures for production dahi and other fermented milks.
- Organisation : National Dairy Research Institute, Karnal 132 001.
- Project Category : Applied.
- Cost : -
- Duration : 1976-1981.
- Sponsor(s) : ICAR
- Investigator(s) : Jasjit Singh; Srinivasan, R.A.
- Description : Selected UV induced mutants of *Streptococcus lactis*, subsp. *diacetylacis* were inoculated individually in cow milk, buffalo milk and goat milk. After incubation for 16 hours at 30 C, the cultures were examined for their acid and flavour production. It was observed that UV-induced mutants showed better performance as compared to their parent culture. The biochemical activity was better with all the test cultures in buffalo milk than in cow or goat milk. Trials were also conducted with parent and gamma-radiation induced mutant cultures of *Lactobacillus bulgaricus* in skim milk obtained from different milk species. These cultures showed better biochemical activity in buffalo skim milk than in that from cow or goat. These cultures also showed no production of flavouring compounds in different types of milks used.
- Report(s) : Annual report.
- Papers Published : 1. Jasjit Singh and Khanna, A. Effect of incubation temperature and heat treatment of milk from cow and buffalo on acid and flavour production by *Streptococcus thermophilus* and *Lactobacillus bulgaricus*. J. Food Protection. 43; 1980; 399.
2. Jasjit Singh and Ranganathan, B. Activity of *Lactobacillus casein* and its gamma radiation induced mutant in different types of milk. Milchwissenschaft. 34; 1979; 91.
3. Jasjit Singh and Ranganathan, B. Caseinolytic activity *Lactobacillus bulgaricus* and its mutant. Milchwissenschaft. 34; 1979; 20.
4. Jasjit Singh and Ranganathan. Increased formation of carboxyl compounds of milk fat by mutants of lactic acid bacteria. Milchwissenschaft. 36; 1981; 266.
5. Jasjit Singh and Ranganathan, B. Release of soluble and amino nutrition in individual casein fraction by *Lactobacillus* mutants. Milchwissenschaft. 34; 1979; 288.
- 802 Project Title : Role of *Bacillus cereus* in the spoilage of dairy products and its potentialities in the production of enterotoxins.
- Organisation : National Dairy Research Institute, Southern Regional Station, Aduodi, Bangalore.

Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Chitralekha Edwin; Nambudripad, V.K.N.  
 Description : In a study of incidence of *B. cereus* in milk and milk products, 239 lecithinase positive spores were isolated from 170 samples and 152 were identified as *B. cereus*. Several of these produced renins like enzymes, phosphatase, hemolysin and TDNase. The wild strains (8 nos) positive for the above characteristics and a standard strain (B-48 Merrell) were studied for enterogenicity in guinea pigs and rabbits. Injection of supernates of test cultures to guinea pigs produced dermonecrotic reactions. In rabbit iliac loop test, all but one strain resulted in accumulation of a dark brown viscous fluid in the ileum. An attempt was also made to raise anti serum against *B. cereus* enterotoxin by immunisation in rabbits.  
 Report(s) : Annual.  
 Papers Published : -

803 Project Title : Studies on the antibacterial effect of selected strains of Lactobacilli against food poisoning organisms.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979-1981.  
 Sponsor(s) : ICAR  
 Investigator(s) : Amin, J.B.; Singh, R.S.  
 Description : Antibacterial activity of four strains of *L. bulgaricus* and six strains of *L. acidophilus* were screened using *Micrococcus flavus* and *Pseudomonas fragi*. Of the various methods tried, the agar well method was found most suitable. A strain of *L. bulgaricus* was selected as having more antibacterial activity and was also tested against *Salmonella shigella*, enteropathogenic *E. coli*, *Staphylococcus aureus*, *Enterococcus faecalis*, *Bacillus cereus*, *Proteus vulgaris* and *pseudomonas arruginosa*. The nature of the antibacterial substance was also studied.  
 Report(s) : Annual.  
 Papers Published : -

804 Project Title : Associative growth of lactic acid and propionic acid bacteria in milks.  
 Organisation : National Dairy Research Institute, Southern Research Station, Aduvodi, Bangalore.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979-1981  
 Sponsor(s) : ICAR  
 Investigator(s) : Jagannath, E.G.; Nambudripad, V.K.N.  
 Description : Of the three media, namely, milk media, carrot extract and media fortified with carrot extract, the second named exerted significant influence on the growth of Lactobacilli (*L. helveticus* and *plantarum*) and Propionobacter (*P. shermanii*) individually as well as on their associative growth. In milk media consisting of varying amounts of carrot extract, the rate of acid production was high but ceased to be of high significance beyond 20% level. Associative growth in all the three media influenced production of steam volatile acids



and CO<sub>2</sub>. In mixed cultures, significant increase in viable cell population was observed during first 48 hours and thereafter no notable stimulation was observed. The associative growths of lactic streptococci belonging to the groups of lactis, cremoris and thermophilus in milk and milk media and milk media fortified with vegetable extracts are now being studied. Growth of lactobacilli and lactic streptococci in association with *P. shermanii* under simulated conditions of cheese with respect to production of steam volatile acids and CO<sub>2</sub> production and protein breakdown will also be studied.

Report(s) : Annual.

Papers Published : -

805 Project Title : Studies and extraction, purification and properties of chymosin from buffalo calves.

Organisation : National Dairy Research Institute, Karnal.

Project Category : Applied.

Cost : -

Duration : 1980-1983

Sponsor(s) : ICAR

Investigator(s) : Surender Rao, T; Dutta S.M.

Description : Of the four extraction procedures (10% NaCl, 10% NaCl containing 5% glycerol and 2% boric acid, 12% CaCl<sub>2</sub> and 0.04N HCl), quickest extraction was obtained by HCl (just 8 minutes as against hours with others). With HCl extraction activation of the enzyme was also quicker (almost immediate). The enzyme could be purified (16-fold) by ethanol fractionation, ion exchange chromatography and gel filtration with an overall recovery of 20%. Ratio of milk clotting activity to proteolytic activity was also studied and found to be highest in buffalo chymosin followed by cow calf chymosin and bacterial rennet. The properties of chymosin were also studied in detail.

Report(s) : Annual.

Papers Published : -

806 Project Title : Studies on  $\beta$ -galactosidase from *Kluyveromyces fragilis*.

Organisation : National Dairy Research Institute, Karnal 132 001; Dairy Bacteriology Division.

Project Category : Applied.

Cost : -

Duration : 1979-1981

Sponsor(s) : ICAR

Investigator(s) : Haripal Singh; Dutta, S.M.

Description : Optimal cultural conditions for enzyme production were investigated. The enzyme synthesis was maximum just before the onset of stationary growth phase (12 hours). Further incubation resulted in loss of enzyme activity. Of the different types of whey studied for effect on enzyme production, whey reconstituted to 8-12% total solids gave best results. Heat treatments (63 C for 30 min and 121 C for 15 min.) had no significant effect on enzyme production. Though no effect on growth was observed between pH 4-6, enzyme production was maximum at pH 4.0. Fortification of whey with inorganic and organic nitrogen sources, growth factors and mineral salts slightly stimulated enzyme production. An appreciable increase was also obtained by supplementation with peptone, protease-peptone, tryptone,

tryptose, casein hydrolysate, yeast extract, beef extract and corn steep liquor. However, casein malt extract and molasses had little effect.  $Mn^{++}$  and  $Mg^{++}$  gave slight increase in enzyme production while  $Na^+$   $K^+$  and  $Ca^{++}$  had no effect. Sonification of the yeast cells for 2 minutes (60w) or grinding with chloroform at 4 C also gave effective extraction of the enzyme. Enzyme purification studies are underway. Studies on its properties and immobilisation will also be conducted.

Report(s) : Annual report.  
Papers Published : -

807 Project Title : Studies on preparation and properties of  $\beta$ -galactosidase of microbial origin.  
Organisation : National Dairy Research Institute, Karnal 132 001; Dairy Bacteriology Division.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : ICAR  
Investigator(s) : Ramana Rao, M.V.; Dutta, S.M.  
Description : Crude enzyme prepared from *S. thermophilus* grown in supplemented whey hydrolysed lactose at 45 C in solution and skim milk within 120 and 90 minutes respectively. Enzyme units/litre of medium and the specific activity of the crude enzyme were 3-fold more than those of *K. fragilis* enzyme. The rate of ONPG hydrolysis was higher than that of yeast enzyme. The *S. thermophilus* enzyme was more heat stable than that of *K. fragilis* enzyme. It did not lose activity at -40 C for over a year. It had the same optimum pH as *K. fragilis* enzyme (pH 6.8) and had the advantage of a higher optimum temperature (55 $\pm$ 1 C as compared to 44 $\pm$ 1 C of the other enzyme). The cultures are now being screened for the presence of Phosphobeta galactosidase activity. Work will be started on lactose utilisation in *L. casei*.  
Report(s) : Annual report.  
Papers Published : 1. Agarwal, Sanjeev and others. Thermostable  $\beta$ -galactosidase from fungi. J. Dairy Sci. 65; 1982; 866  
2. Jagota, S.K. and others.  $\beta$ -galactosidase of *Streptococcus cremoris* H. J. Food Sci. 46; 1981; 161.  
3. Ramana Rao, M.V. and Dutta, S.M. An active betagalactosidase preparation from *Streptococcus thermophilus*. Indian J. Dairy Sci. 32; 1979; 187.  
4. Singh, H.P. and others. Partial purification and properties of *Leuconostoc citrovorum* betagalactosidase. Milchwissenschaft. 34; 1979; 475.

808 Project Title : Studies on rennin and protennin from goat kids.  
Organisation : National Dairy Research Institute, Karnal.  
Project Category : Applied.  
Cost : -  
Duration : 1981-1983.  
Sponsor(s) : ICAR  
Investigator(s) : Angelo, I.A.; Mathur, M.P.  
Description : Rennet was extracted from abomasa of 6 day old male kids (4 Nos) by sodium precipitate method. The yield was 1250 rennin units/abomasa. The ratio of milk clotting activity to proteolytic activity of crude extract was 0.92 which could be increased 8-fold by sieving the extract through



Biogel P-30. DEAE cellulose chromatography of Biogel purified rennet fraction using phosphate buffer (pH 5.7) and step-wise sodium chloride gradients resulted in 8 fractions. Two major fractions showed milk clotting activity.

Report(s) : Annual.

Papers Published : 1. Angelo, I.A. Incorporation of <sup>84</sup>C-amino acid into prorennin and rennin in cow calf abomasum in vivo. *Milchwissenschaft*. 36; 1981; 399  
2. Angelo, I.A. A note on the incorporation of <sup>14</sup>C-aminoacids by tissue proteins of abomasa from calves fed with milk powder. *Milchwissenschaft*. 36; 1981; 487.

809 Project Title : Studies on production, purification and characterisation of milk clotting enzyme obtained from *Absidia ramosa*.  
Organisation : National Dairy Research Institute, Karnal 132 001; Dairy Bacteriology Division.  
Project Category : Applied.  
Cost : -  
Duration : 1975-1982.  
Sponsor(s) : ICAR  
Investigator(s) : Srinivasan, R.A. and others.  
Description : Extensive trials on the production and extraction of the enzymes using semi solid wheat bran were conducted. Purification of the enzyme was by fractional precipitation with ammonium sulphate and acetone. The acetone present in the redissolved enzyme was removed by vacuum evaporation. Studies with the enzyme are currently in progress. Further work envisaged includes study of the properties of the purified enzyme in comparison with those of animal rennet and the feasibility of liquid media for production of the enzyme.  
Report(s) : Annual report.  
Papers Published: : -  
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810 Project Title : Coagulation of milk with immobilised milk clotting enzymes.  
Organisation : National Dairy Research Institute, Karnal.  
Project Category : Applied.  
Cost : -  
Duration : 1981-1984  
Sponsor(s) : ICAR  
Investigator(s) : Mathur, M.P. and others.  
Description : Efforts to standardise conditions for immobilisation of milk clotting enzyme on river bed sand were made. About 33% of the enzyme was bound to silanised sand became Hansen rennet which exhibited milk clotting ability. In efforts to determine loss of rennet while in use, if any, it was found that there was no leaching of the enzyme. In the limited trials, it was indicated that with an increase in contact time of milk with immobilised rennet, a shortening in the clotting time of enzyme treated milk occurred. High proportion of pepsin was indicated in the rennet preparation by the low ratio of milk clotting to proteolytic activity of immobilised Hansen.  
Report(s) : -  
Papers Published : 1. Angelo, I.A. An appraisal of rennets from fistulated cow and buffalo calves and goat kid and Hansen rennet through chromatography and electrophoresis. *Milchwissenschaft*. 36; 1981; 147.  
2. Angelo, I.A. and others. Application of immobilised enzymes to the food and dairy industries. *Dairy Guide*. 4(6); 1982; 45.

3. Datta Roy, D. and others. Hydrolysis of milk proteins by pepsin at pH 2.2 in vitro. Dairy Guide. 4(5); 1982; 21.
4. Mathur, M.P. and Datta Roy, D. Milk enzymes and their role. Dairy Guide. 4(10); 1982; 9

- 811 Project Title : Studies on extra cellular proteases of *Streptococcus liquefaciens*.  
 Organisation : National Dairy Research Institute, Karnal 132 001; Dairy Bacteriology Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979-1981.  
 Sponsor(s) : ICAR  
 Investigator(s) : Abraham, M.J; Srinivasan, R.A.  
 Description : Several media were tried for growth and elaboration of the enzyme. Maximum enzyme was produced in sterile skim milk at 37 C between 20-24 hrs. Efforts were made to formulate a semisynthetic medium with deprotenised whey as basal medium supplemented by various concentrations of different protein sources. In all cases growth was observed without enzyme production except with whole casein and casamino acids. Elaboration of the enzyme required gelatin medium to be supplemented by a large number of amino acids. In studies, on effects of other factors like nutrition, pH, temperature of incubation etc. it was found enzyme production was optimal at 35-37 C but was inhibited below 35 C and above 37 C. Recovery with acetone after precipitation with ammonium sulphate and purification studies were also carried out. Addition of  $\text{Ca}^{2+}$  or lowering of pH enhanced clotting activity. Optimum enzyme activity was found at pH 7.4. Enzyme characterisation studies are in progress.  
 Report(s) : Annual report.  
 Papers Published : -
- 812 Project Title : Studies on the protease of psychrotrophic bacteria.  
 Organisation : National Dairy Research Institute, Karnal 132 001; Dairy Bacteriological Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1971-1981  
 Sponsor(s) : ICAR  
 Investigator(s) : Malik, R.K.; Mathur, D.K.  
 Description : In continuation of isolation studies, samples of D.T. flavoured milk, fresh butter and ice cream mix were analysed for total bacterial count, psychrotrophic count and proteolytic psychrotrophic count. In all 259 protease producing psychrotrophic bacteria from different milk products were isolated, and screened for the production of extra cellular protease. Of the above, 89 exhibited more than 150 units of protease activity. On further screening of these isolates for heat stability, the isolate B-25 belonging to *Pseudomonas* genus was chosen for further studies on production, purification and characterisation of the enzyme.  
 Report(s) : Annual.  
 Papers Published : -



- 813 Project Title : Studies on psychrotrophic lactic acid bacteria in pasteurised milk with special reference to proteolytic activity.
- Organisation : National Dairy Research Institute, Karnal 132 001; Dairy Bacteriology Division.
- Project Category : Applied.
- Cost : -
- Duration : 1979-1981.
- Sponsor(s) : ICAR
- Investigator(s) : Sundarsanam, T.S.; Srinivasan, R.A.
- Description : Isolation trials (100 nos.) indicated preincubation of samples at 5-7 C for a minimum of 120 hours was necessary before plating. After 7 days of incubation at 5-7 C abundant were lactic bacteria were noticed. The psychrotrophic bacteria (55 strains) represented those from *S. lactis*, *S. cremoris* and *S. diacetylactis*. Three selected strains, one from each group, were active even after 2 months storage in yeast dextrose litmus milk at 5-7 C. One of the isolates, that from *S. lactis* showed increased tyrosine value (upto 57 units) and acidity (upto 0.22%) when inoculated into skimmed and whole milk and incubated for 5 days at 5-7 C. The influence of this strain on the quality of milk in regard to protein degradation and some of the properties of proteolytic enzyme was also studied. Further studies being done include those on optimum conditions for proteolytic activity of the selected isolate; changes induced by it on protein constituents of pasteurised milk; some properties of partially purified protease; temperature and pH optimum, heat stability and action on casein and its fractions.
- Report(s) : Annual report.
- Papers Published : -
- 814 Project Title : Reduction of proteolytic activity of the milk clotting enzymes from *Bacillus subtilis* K-26 and *Absidia ramosa*.
- Organisation : National Dairy Research Institute, Karnal 132 001.
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : ICAR
- Investigator(s) : Krishna Rao, L; Sannabhadti, S.S.
- Description : The milk clotting enzyme was produced from *B. subtilis* K-26 and *A. ramosa* in a 10 litre fermentor at the agitation speed of 400 rpm and aeration rates of 3000 cc with the temperature at 37 C. The crude enzymes were tested for milk clotting and proteolytic activity using various adsorbents. None of the adsorbents gave significant results. Only activated charcoal, casein and gamma alumina gel were comparatively better. Similar studies were also conducted with *Absidia ramosa*.
- Report(s) : Annual.
- Papers Published : 1. Krishna Rao, L. and Mathur, D.K. Purification and properties of milk clotting enzymes from *Bacillus subtilis* K.26. *Biotechnol. Bioeng.* 21(4); 1979; 535.  
2. Krishna Rao, L. and Mathur, D.K. Assessment of purified bacterial milk clotting enzyme from *Bacillus subtilis* K-26 for cheddar cheese making. *J. Dairy Sci.* 62(3); 1979; 378.

Project Title : Hydrolysis of milk lactose by immobilized lactase using whole cells of *Escherichia coli*.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Rajni Kaul and others.  
 Description : Lactase was immobilized using the whole cells of *Escherichia coli* (prior induced for the enzyme) on hen egg white cross-linked with glutaraldehyde. The preparation could be effectively used for hydrolysis of lactose in milk. The immobilised enzyme could be used repeatedly in a batch reactor without appreciable loss in efficiency.  
 Report (s) : -  
 Papers Published : Hydrolysis of milk lactose by immobilized lactase using whole cells of *Escherichia coli*. Presented at the DAE symposium on Nutrient Transport Studies in Animals for the purpose of milk and meat production, at National Dairy Research Institute, Karnal, November 1981.

#### Animal and Meat Products

816 Project Title : Radiation induced alterations in meat pigments.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Paul, P. and others.  
 Description : Preservation of meat by  $\gamma$ -irradiation produced changes in myoglobin which affected the colour. Irradiation (1 kGy) resulted in the partial unfolding of the myoglobin molecule. UV fluorescence spectral studies revealed that in this unfolded state there was partial destruction of tryptophan. Irradiated myoglobin reduced the requirement of nitrite by 50% to the form NoMb, the cured meat colour. Isoelectric focusing patterns of irradiated myoglobins are being studied.  
 Report(s) : -  
 Papers Published : -

817 Project Title : Studies on the shelf-life of meat food products in relation to microbial spoilage.  
 Organisation : Central Agmark Laboratory, Nagpur 440 010.  
 Project Category : Applied.  
 Cost : Rs. 20,000/-.  
 Duration : 1981-1986.  
 Sponsor(s) : Directorate of Marketing and Inspection.  
 Investigator(s) : Upadhyaya, S.N. and others.  
 Description : The project analyses the shelf life of four meat food products and their relation to microbial spoilage.  
 Report(s) : -  
 Papers Published : -

818 Project Title : Physico-chemical factors as basis of storage warranty in canned meat products.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Meat, Fish and Poultry Technology Discipline.  
 Project Category : Applied.



- Cost : Rs. 48,500/-.
- Duration : June 1982-May 1987
- Sponsor(s) : Institute.
- Investigator(s) : Venkatasubbaiah, G. and others.
- Description : Corned beef was prepared in the laboratory and after ascertaining microbial safety, was analysed for different components. There appeared to be reduction in water-soluble and buffer soluble nitrogen. Beef was subjected to different heating times and analysed for creatinine which was also estimated in corned beef. Creatinine content also differed. The colour also appeared to be different between samples from top and bottom sides of the can.
- Report(s) : -
- Papers Published : -
- 819 Project Title : Development of process for the manufacture of meat preserves.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Meat, Fish and Poultry technology Discipline.
- Project Category : Applied.
- Cost : Rs. 93,600/-.
- Duration : 1982-1984
- Sponsor(s) : Institute.
- Investigator(s) : Kadkol, S.B. and others.
- Description : Kinetics of equilibrium of fresh and cooked pork treated with brine of different strengths (5,10,15,23%) was studied. It was found that the salt and the moisture content of the raw and cooked pork were influenced by the meat to brine ratio and the strength of the brine. Studies on the treatment of fried meat with brine of different strengths and on the treatment of meat with acidic brines are in progress. Studies on the use of lactic acid producing organisms to extend the shelf life of meat and for use in the manufacture of preserves have been initiated.
- Report(s) : -
- Papers Published : -
- 820 Project Title : Studies on processing and preservation of meat pickles.
- Organisation : Indian Veterinary Research Institute, Izatnagar 243 122; Division of Livestock products technology.
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : Institute.
- Investigator(s) : Padda, G.S.; Sharma, N.
- Description : The project aims to standardize recipes for meat pickles and evaluate their suitability and consumer acceptability.,
- Report(s) : Annual report.
- Papers Published : -
- 821 Project Title : Acceptability trials on conditioned mutton.
- Organisation : Central Food Technological Research Institute, Mysore 570013; Meat, Fish and Poultry Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 44,500/-.
- Duration : July 1980-December 1980
- Sponsor(s) : Institute.
- Investigator(s) : Dani, N.P. and others.
- Description : Acceptability trials were carried out on various portions from thigh muscle of Bannur sheep (market sample) conditioned

by overnight storage at controlled time temperature schedule and chilling for 20 hours. The evaluation was carried out by a combination of sensory and instrumental techniques. The conditioned mutton was found acceptable in terms of tenderness and overall quality, The curry from conditioned meat was also preferred to that from fresh meat requiring shorter time for optimum doneness.

Report(s) : -  
Papers Published : -

822 Project Title : Accelerated conditioning of mutton.  
Organisation : Central Food Technological Research Institute, Mysore-570013.  
Project Category : Applied.  
Cost : Rs. 95,000/-.  
Duration : April 1981-March 1983  
Sponsor(s) : Institute.  
Investigator(s) : Dani, N.P. and others.  
Description : To arrive at time-temperature schedule for hot processing, protein extractability, pH fall and microbial load for a period of 6-8 hours were studied on carcasses. Myofibrillar muscle extraction in KCl-PO<sub>4</sub> buffer in neck muscle decreased upto 6 hours post-mortem coinciding with the onset of rigor mortis. Stroma fraction and NPN did not change. There was indication of reduction in microbial count between 0 - 6 hours post-mortem under storage at 22-24 C. Under commercial conditions of slaughter higher microbial load (10<sup>6</sup>-10<sup>7</sup>/sq.cm) than with training abattoir (10<sup>3</sup>/sq.cm) existed. Sensory evaluation showed aroma quality gradually increased with concentration upto a stage and then started decreasing. Between fast cooking (85 C for 40 min.) and slow cooking (upto 85 C for 1 hour for 20 min) in sealed pouches, the former retained aroma and uniformity of muscle fibres. Panel findings on tenderness correlated with shear values.

Report(s) : -  
Papers Published : 1. Dani, N.P. and others. Effect of conditioning and carcass posture on eating quality of mutton from old Bannur ewes. Meat Sci. 6(4); 1982; 265

823 Project Title : Storage stability of radurised mutton and pork.  
Organisation : Bhabha Atomic Research Centre, Bombay.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Centre.  
Investigator(s) : Ghosh, S.K. and others.  
Description : Unirradiated samples developed intense putrid odours within 5 days storage at 0-2 C as compared with irradiated samples (0.25-0.5 Mrad) which were acceptable for 20-25 days. Irradiation reduced bacterial load by 2-3 log cycles though it increased slowly during storage at 0-2 C. The extent of spoilage could be correlated with TBA and heme pigment solubility. Drip loss was 8-10% during storage while treatment with 10% triphosphate for 10 min. prevented it.

Report(s) : -  
Papers Published : -

824 Project Title : Determination of adequate process parameters for canned products.  
Organisation : Central Food Technological Research Institute, Mysore-570013; Meat, Fish and Poultry Technology Discipline.



- Project Category : Applied.  
 Cost : Rs. 88,400/-.  
 Duration : May 1980-April 1983.  
 Sponsor(s) : Institute.  
 Investigator(s) : Baliga, B.R. and others.  
 Description : D and Z values for thermal resistant organism PA 3679 were determined by tube method. The D value at 230 F (110 C), 240 F (115.6 C) and 250 F (121.1 C) were 10, 3.5 and 1.1 minutes respectively. The Z value determined from the TRT curve was 21 F (11.6 C). Heat penetration in canned products like corned beef, kheema-in-curry and chunks-in-curry packed in cans of sizes 301x109, 301x311, 301x409 and 401x411 were studied and data generated. A lethality of 1.16 was obtained in corned beef packed in 301x409 can processed at 110 C for 60 minutes. Further studies are in progress.
- Report(s) : -  
 Papers Published : -
- 825 Project Title : Microbiological examination of meat and beef sold in Parbhani city.  
 Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani 431 402; Department of Food Science and Technology.  
 Project Category : Applied.  
 Cost : Rs. 4,000/-.  
 Duration : June 1980-June 1982.  
 Sponsor(s) : University.  
 Investigator(s) : Powar, R.E. and others.  
 Description : The project is concerned with (a) microbiological analysis of mesophilic (TPC), thermophilic, psychrophilic and yeast and mould counts in meat and beef sold in Parbhani city, b) Isolation of specific genera of pathogenic organisms like Salmonella, Staphylococcus and Escherichia species from the meat samples and (c) assessment of hygienic quality and effect of handling on the microbial load of the meats. Results obtained so far show higher microbial counts in meat than in beef, the average total plate count in meat samples far exceeding the prescribed standards. However, samples drawn during mornings showed lower microbial counts. Specific pathogenic genera, viz., Salmonella, E. coli and S. aureus were isolated from all samples indicating the prevailing unsanitary and unhygienic conditions prevailing in the local meat market. Similar studies will be extended to other food materials in future.
- Report(s) : -  
 Papers Published : -
- 826 Project Title : Detection of adulteration of meat by immunological technique.  
 Organisation : Central Food Technological Research Institute, Mysore 570013.  
 Project Category : Applied.  
 Cost : Rs. 36,700/-.  
 Duration : May 1982- April 1984.  
 Sponsor(s) : Institute.  
 Investigator(s) : Baliga, B.R. and others.  
 Description : Juice expressed from mutton, beef and buffalo meats were used for producing antisera in injection into rabbits. The bacterial load of juice from market meat ranged from 60,000-1,40,000 per ml and had to be reduced before injection by passing through Seitz filter or by adding streptopenicillin.

The meat juice (protein concentration 10 mg/ml) was injected at different intervals with a special adjuvant for producing antisera; three injections at 15-day intervals produced antisera which was tested by gel diffusion by Ouchterlons technique. The antisera produced using sheep meat was reactive against goat meat antigen. Antisera against sheep, beef and buffalo meat is being produced. Efforts are also being made for antisera generation by using extracts of cooked meat.

- Report(s) : -  
 Papers Published : -
- 827 Project Title : Study of modern abattoir practices for collection of data on yield, utilization of meat and by products, cost, etc. improvement of the existing abattoirs with simple devices.
- Organisation : Central Food Technological Research Institute, Mysore 570013; Meat, Fish and Poultry Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 1,50,000/-.
- Duration : February 1979-January 1981.
- Sponsor(s) : Institute.
- Investigator(s) : Moorjani, M.N. and others.
- Description : Studies of conventional practices in Mysore revealed inhumane and unhygienic conditions of slaughter, dressing and evisceration of animals leading to reduced yields and microbiological contamination. The modern methods of slaughter was studied in the training abattoir for comparison. The carcass yields were higher (in sheep, 45.5-48%; pigs 65-70%) and chilling losses were lower (in sheep 2.3-4.0%). The microbial counts were within prescribed limits and Salmonella was absent. In studies on utilisation of blood, it was found that in sheep, less blood was obtained with electrical stunning, (400-500 ml) than without stunning. In pig, the blood was collected only after stunning. The reddish plasma was freeze dried and packed in cryovac bags under vacuum. The solubility of plasma under different conditions of processing, packaging and storage was also studied. Mini abattoirs which can handle very small number of animals and thus useful in small towns have been designed.
- Report(s) : Consolidated report.
- Papers Published : 1. Narasimha Rao, D. Microbiological studies of minced meat processed under hygienic conditions in modern abattoir. Presented at Second Indian Convention of Food Scientists and Technologists, Mysore, February 1981.
- 828 Project Title : Designing of small/medium sized modern type slaughter houses to suit the Indian conditions.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Meat, Fish and Poultry Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 77,000/-.
- Duration : April 1981-March 1982.
- Sponsor(s) : Institute.
- Investigator(s) : Moorjani, M.N. and others.
- Description : Small sized abattoir complex was designed for handling a kill of 250 sheep, 25 cattle and 8 pigs per a 5-hour day. The design incorporates economical equipment to slaughter animals under hygienic conditions.
- Report(s) : -
- Papers Published : -



- 829 Project Title : Influence of electrical stunning on quality of mutton.  
 Organisation : Central Food Technological Research Institute, Mysore-570013;  
 Project Category : Applied.  
 Cost : Rs. 43,100/-  
 Duration : July 1979-June 1980.  
 Sponsor(s) : CSIR  
 Investigator(s) : Dani, N.P. and others.  
 Description : To study the effect of stress on stunning, methods for estimating lactic acid and glucose in vivo and in vitro in sheep blood samples were standardised. Glycogen was estimated at 1 and 4 hours post-mortem to follow glycolytic changes in electrically stunned and conventionally stunned (market samples) slaughtered and conventionally stunned slaughtered sheep. Methods of estimating haemoglobin in sheep blood were worked out. Physical quality parameters like water holding capacity and W.B. shear were estimated on muscle samples of slaughtered sheep and the meat subjected to sensory evaluation by a trained panel. In market samples of blood, lactic acid varied from 10.5 to 61.5 mg/100 ml and glucose levels ranged from 52.0 to 69.0 mg/100 ml. In Bannur sheep (from Karnataka), lactic acid and glucose levels varied from 39.0 to 12.9 mg and 6.0 to 231.5 mg respectively. Glycogen in the neck muscle was 204 to 279 mg/100 g (1 hour postmortem) and 0 to 78.1 mg/100 g (4 hours post-mortem) respectively. Haemoglobin content of muscle varied from 0.3 to 1 mg/g. There was no variation in water holding capacity between stunned and unstunned sheep.  
 Report(s) : Consolidated report.  
 Papers Published : -
- 830 Project Title : Beneficiation of animal blood into value added fractions.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Meat, Fish and Poultry Technology Discipline.  
 Project Category : Applied and Developmental.  
 Cost : Rs. 42,450/-.  
 Duration : October 1978-September 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Moorjani, M.N. and others.  
 Description : The process for plasma production as cellular fraction was worked out and cost analysis study made.  
 Report(s) : Final.  
 Papers Published : 1. Moorjani, M.N. and others. Utilisation of blood from slaughter house. Presented at 24th meeting of Meat Research Workers, Kumbach, Federal Republic of Germany, September 1978.

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### Buffalo Meat

- 831 Project Title : Characteristics of buffalo meat.  
 Organisation : Indian Veterinary Research Institute, Izatnagar 243 122; Division of Livestock products technology.  
 Project Category : Fundamental.  
 Cost : -  
 Duration : 1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Kondaiah, N. and others.  
 Description : 80 live buffaloes and their respective carcasses were evaluated for some meat quality traits. Breed, age, sex and

conformation on live buffaloes, sex, carcass conformation, fat score, eye muscle colour and L.D. muscle area on carcass were recorded for 1622 live buffaloes and 541 carcasses. Data is analysed and conclusions are being drawn.

Report(s) : Annual report.  
Papers Published :

832 Project Title : Utilization of buffalo meat and utilisation of intestines of large animals.  
Organisation : Central Food Technological Research Institute, Mysore-5/0013; Meat, Fish and Poultry Technology Discipline.  
Project Category : Applied.  
Cost : Rs. 82,000/-.  
Duration : April 1978-March 1980.  
Sponsor(s) : Institute.  
Investigator(s) : Baliga, B.R. and others.  
Description : Buffalo meat (bought as quarters) were examined bacteriologically and loaded into chilling rooms 4 - 34 hours after slaughter. With overnight chilling, pH at various locations of the quarter varied between 7.3 to 6.0. The chilled quarters were cut into prime cuts and data were collected on yield of different cuts, meat fat and bone as well as chemical composition including protein fractionation and microbiological status. The deboned meats (mince and chunks) were evaluated for freezing rates and it was found the time required for lowering the temperature of these products to 0 F (-18 C) was 1 hour and 15 minutes. Ham and bacon-like products from the primal cuts were attractive in colour and flavour but for slight fibrous texture which could be reduced by suitable processing. Moulded ham prepared from minced meat and meat loaf based on buffalo meat and vegetables compared well with product made with beef.  
Report(s) : Final.  
Papers Published : 1. Madhavi, D.L. and others. Essential amino acid content of buffalo meat. J. Food Sci. Technol. 19(5); 1982; 214  
2. Madhwaraj, M.S. and others. Corned beef and buffalo meat. Presented at Second Indian Conventional of Food Scientists and Technologists, CFTRI, Mysore, February 1981.

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### Pork

833 Project Title : Studies on processing and preservation of pork sausages.  
Organisation : Indian Veterinary Research Institute, Izatnagar 243 122; Division of livestock products technology.  
Project Category : Applied.  
Cost : -  
Duration : 1980-  
Sponsor(s) : Institute.  
Investigator(s) : Padda, G.S. and others.  
Description : The standardization of high quality, low cost recipes of pork sausages suitable to Indian taste are being attempted. The suitability of unconventional and cheaper binders and fillers in sausages are being investigated.  
Report(s) : Annual Report.  
Papers Published :



## Poultry products

- 834 Project Title : Technological studies on egg and meat of desi birds.  
 Organisation : Central Avian Research Institute, Izatnagar 243 122.  
 Project Category : Applied.  
 Cost : Rs. 25,000/-.  
 Duration : January 1981 - December 1981.  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Mahapatra, C.M. and others.  
 Description : The project intends to evaluate the quality of egg and meat of desi birds and also to compare the data with those of exotic ones.  
 Report(s) : -  
 Papers Published : -
- 835 Project Title : Effect of inclusion of marigold flower meal in practical poultry ration on broiler meat appearance and intensity of yolk colour.  
 Organisation : Tamil Nadu Agricultural University, Veterinary College, Madras; Department of Poultry Science.  
 Project Category : Applied.  
 Cost : Rs. 15,000/-.  
 Duration : 1979-1981.  
 Sponsor(s) : University.  
 Investigator(s) : Vedhanayagam, K.  
 Description : The carotenoid content of the marigold flower meal and the effect of the meal in maize free broiler and layer ration on broiler pigmentation and the yolk colour in eggs have been studied. The different naturally available pigments compared for their pigmenting capacity and the cost and economics for the incorporation of pigments in maize free diet have been worked out.  
 Report(s) : -  
 Papers Published : -
- 836 Project Title : Preparation of tandoori chicken and its keeping qualities.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Meat, Fish and Poultry Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 23,960/-.  
 Duration : December 1978-November 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Haleem, M.A. and others.  
 Description : Various parameters like age and weight of the bird, temperature of cooking oven, cooking loss and holding time in the oven were investigated in relation to their influence on the quality of tandoori chicken. Consumer acceptance studies on tandoori chicken in different forms (like frozen and canned) were also carried out. Conditions for optimum quality product for export and internal consumption were standardised.  
 Report(s) : Final  
 Papers Published : -  
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- 837 Project Title : Basic studies on tandoori chicken for its quality improvement.  
 Organisation : Central Food Technological Research Institute, Mysore-570013;  
 Project Category : Applied.

- Cost : Rs. 34,592/-  
Duration : July 1981-July 1982.  
Sponsor(s) : Institute.  
Investigator(s) : Haleem, M.A. and others.  
Description : Marination of tandoori chicken with curd and acetic acid during intervals of half an hour for a period of 4 hours have shown increase in tenderness. The sampling procedure is being standardized for tenderness values for chicken of age group between 4 to 8 weeks. The carcass data at different stages of growth has been collected and is co-related with the tenderness to ascertain optimum age and acceptability for tandoori chicken.
- Report(s) : -  
Papers Published : -
- 838 Project Title : Effect of polyphosphates on ready-to-cook broilers and its influence on subsequent cooking.  
Organisation : Tamil Nadu Agricultural University; Veterinary College, Madras. Department of Poultry Science.  
Project Category : Applied.  
Cost : Rs. 15,000/-.  
Duration : October 1981-October 1982.  
Sponsor(s) : University  
Investigator(s) : Srinivasan, M.; Gabriel Raj. A.  
Description : The optimum duration for polyphosphate treatment for increasing the keeping quality of ready-to-cook chicken is being explored and its effect on the tenderness of ready-to-cook chicken, and tenderness and juiciness of cooked chicken, is being assessed. The influence of polyphosphate on the rancidity of fat during storage of ready-to-cook chicken and on the water holding capacity of the ready-to-cook chicken are also being investigated.
- Report(s) : -  
Papers Published : -
- 839 Project Title : Effect of different methods of chilling and subsequent preservation at low temperatures of quality of quail meat.  
Organisation : Central Avian Research Institute, Izatnagar 243 122.  
Project Category : Applied.  
Cost : Rs. 50,000/-.  
Duration : January 1981-December 1982.  
Sponsor(s) : Indian Council of Agricultural Research.  
Investigator(s) : Pandey, N.K. and others.  
Description : A prompt and efficient method of chilling of quail carcasses and a study of the changes occurring in the quality and acceptability during their subsequent preservation at refrigeration and freezing temperatures are being investigated.
- Report(s) : -  
Papers Published : -
- 840 Project Title : Purification of Cathepsin D.  
Organisation : Bhabha Atomic Research Centre, Bombay.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Centre.  
Investigator(s) : Doke, S.N. and others.



- Description : Cathepsin D was found to be the major intracellular proteinase in chicken and fish skeletal muscles. Methods have been developed to purify and characterize the enzyme. In chicken muscle two fractions of the enzyme were isolated with 113 and 28 fold activity respectively. Cathepsin D from the skeletal muscle of *Tilapia mossambica* was purified 114 fold with 14% recovery.
- Report(s) :
- Papers Published : Doke, S.N. and others. Characterization of cathepsin D from the skeletal muscle of fresh water fish, *Tilapia mossambica*. Agric. Biol. Chem. 44; 1980; 152
- 841 Project Title : Formulation of feeds for cockerels at competitive prices.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Meat, Fish and Poultry Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 32,000/-.
- Duration : April 1980-March 1981.
- Sponsor(s) : Institute.
- Investigator(s) : Haleem, M.A.; Jagannatha Rao, R.
- Description : Chick mash and broiler finisher mash were compared by studying growth of male chicks of layer strain for 12 weeks. The feed conversion was similar in birds fed both the diets. Tenderness score and shear values of meats raised on these two feeds showed only slight differences. However, meats from both batches were tender.
- Report(s) : Consolidated report.
- Papers Published : 1. Haleem, M.A. and others. Studies on preparation of sausages from spent hens. Presented at AFST II Convention of Food Scientists and Technologists at CFTRI, Mysore, February, 19-21, 1981.
2. Boyal, R.K. and others. Studies on consumer egg quality in Mysore. Presented at the 8th annual conference and symposium Indian Poultry Association at Kerala Agric. Univ., Mannuthy, April 23-25, 1981.

### Egg and Egg products

- 842 Project Title : Effect of cold storage on the quality of eggs.
- Organisation : Tamil Nadu Agricultural University; Veterinary College; Madras; Department of Poultry Science.
- Project Category : Applied.
- Cost : Rs. 1,000/-.
- Duration : 1980-1981.
- Sponsor(s) : University.
- Investigator(s) : Muthu, B.
- Description : The project aims to assess the period for which shell eggs can be stored in a public sector cold storage without losing the quality of eggs and its relation with the market quality of eggs at the time of handling for sales at periodic intervals.
- Report(s) : -
- Papers Published : -
- 843 Project Title : Interrelationship of certain physical characteristics of egg shell quality in quail (*Coturnix coturnix* and *japonica*).
- Organisation : Central Avian Research Institute, Izatnagar 243 122.
- Project Category : Survey.
- Cost : Rs. 20,000/-.

- Duration : January 1981-December 1981.  
 Sponsor(s) : Institute.  
 Investigator(s) : Sushil Kumar and others.  
 Description : The project aims at evaluation of the egg shell quality of quail eggs which has direct bearing on the extent of loss during transportation, distribution and marketing due to breakage/cracking of eggs. Data has been collected on 500 quail eggs for different parameters such as specific gravity, egg volume, shell thickness, shell weight, percent shell and egg weight.
- Report(s) : -  
 Papers Published : -
- 844 Project Title : Studies on the quality of market eggs in the city of Madras.  
 Organisation : Tamil Nadu Agricultural University; Veterinary College; Madras; Department of Poultry Science.  
 Project Category : Applied.  
 Cost : Rs. 1,000/-.  
 Duration : 1979-1981.  
 Sponsor(s) : University.  
 Investigator(s) : Vedanayagam, K.  
 Description : The qualities of eggs stored both in the wholesale and retail outlets in the city of Madras are assessed and ways and means to improve their quality are suggested.  
 Report(s) : -  
 Papers Published : -
- 845 Project Title : Comparative studies on the different methods of preservation of table eggs.  
 Organisation : Tamil Nadu Agricultural University; Veterinary College, Madras; Department of Poultry Science.  
 Project Category : Applied.  
 Cost : Rs. 1,000/-.  
 Duration : July 1980-July 1981.  
 Sponsor(s) : University.  
 Investigator(s) : Venugopal, K.  
 Description : The preservation of table eggs in oil, liquid paraffin and lime water has been studied to assess the most suitable method of preservation under room temperature.  
 Report(s) : -  
 Papers Published : -
- 846 Project Title : Preservation and extension of shelf life of shell eggs.  
 Organisation : Tamil Nadu Agricultural University, Agricultural College and Research Institute, Coimbatore 641 003; Food Technology Department.  
 Project Category : Applied.  
 Cost : Rs. 20,000/-.  
 Duration : 1974-1979.  
 Sponsor(s) : University.  
 Investigator(s) : Neelakantan, S.; Shanthi, A.P.  
 Description : The project aims to find some simple way of preserving shell eggs at room temperature by use of edible oils and oil water emulsion. Edible oils like refined oil, groundnut oil and emulsions made of oil and water containing an emulsifier and agri-mycin are used to coat fresh eggs. The eggs are stored at room temperature (28-30 C) and the changes in the quality of eggs measured as loss in weight, yolk index, albumen index, air cell height, smell, taste, etc. are periodically studied.



- Report(s) : Interim.  
 Papers Published : -
- 847 Project Title : Quality of eggs stored at room temperature through the year.  
 Organisation : Tamil Nadu Agricultural University; Veterinary College, Madras-7; Department of Poultry Science.  
 Project Category : Applied.  
 Cost : Rs. 1,000/-.  
 Duration : 1979-1981.  
 Sponsor(s) : University.  
 Investigator(s) : Kothandaraman, P.  
 Description : The project aims to assess the changes in the quality of table eggs stored at room temperature and the number of days the table eggs can be effectively stored at room temperature during the year.  
 Report(s) : -  
 Papers Published : -

### Fish and Seafood

- 848 Project Title : Studies on the microbiological quality and shelf life of fishes raised in livestock sewage ponds.  
 Organisation : Indian Veterinary Research Institute, Izatnagar 243 122; Division of livestock products technology.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-.  
 Sponsor(s) : Institute.  
 Investigator(s) : Bacchil, V.N.  
 Description : The project aims to evaluate the storage property of fishes (whole and eviscerated) at refrigeration temperature and in ice. It also attempts to determine relationship between ERV, pH and counts during low temperature storage and to assess naturally occurring microflora and the microflora associated with the spoilage.  
 Report(s) : Annual report.  
 Papers Published : -
- 849 Project Title : Demand and consumer behaviour towards fish in the urban areas of Shimoga and Chikkamagalur districts.  
 Organisation : University of Agricultural Sciences; College of Fisheries; Mangalore 575 002.  
 Project Category : Survey.  
 Cost : Rs. 3,000/-.  
 Duration : March 1980-July 1982.  
 Sponsor(s) : University.  
 Investigator(s) : Umakanth, D.S.; Krishna Bhatt, C.H.  
 Description : The project is concerned with (a) study of demand for fish in towns (b) study of supply position of marine and fish water fish and (c) study of the pattern of consumption in selected households.  
 Report(s) : -  
 Papers Published : -
- 850 Project Title : Microbiology of fresh and cured marine fish.  
 Organisation : Central Food Technological Research Institute, Experiment Station, Mangalore.  
 Project Category : Applied.  
 Cost : Rs. 1,32,000/-

Duration : July 1976-March 1980.  
 Sponsor(s) : CSIR  
 Investigator(s) : Sripathy, N.V. and others.  
 Description : Various species of fish both from the market and freshly caught, and cured fish were examined for microbiological status and safety. *Penicillium* and *Aspergillus* were common fungi dominant in market sample of cured fish while *Geotrichium*, *Cephalosporium* and *Cespora* were occasional. Among bacterial isolates, coagulase positive *Staphylococci* and *Micrococci* were dominant. *Coryneforms* and *Bacillus* genera were also often present. On enrichment and selective plating, the samples showed many pathogenic isolates indicative of poor sanitary conditions. The samples also showed visible signs of spoilage. Microbiological status of several market samples of specific fish like wet sardines and mackerels were also examined and the spoilage bacteria identified.  
 Report(s) : Final.  
 Papers Published : -  
 \*645

851 Project Title : Studies to characterize the factors involved in the autolytic and microbial spoilage of fresh water fish.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Meat, Fish and Poultry Technology.  
 Project Category : Applied.  
 Cost : Rs. 1,42,250/-.  
 Duration : April 1982-March 1985  
 Sponsor(s) : Institute.  
 Investigator(s) : Balakrishnan Nair, R. and others.  
 Description : Proteolytic changes were observed in fresh water fish muscle during iced storage even under sterile condition indicating the presence of definite catheptic activity. Rapid proteolytic activity followed in non-sterile muscle due to microbial growth. There was concomitant degradation of the myofibrils and connective tissues as observed histologically. A few genera of spoilage organisms were isolated from fresh and spoiling fish. *E coli* was found occasionally, *Salmonella* was absent, and presence of *Staphylococci* was noted only during later stages of storage. *Vibrio* isolates did not reveal any pathogenic species.  
 Report(s) : -  
 Papers Published : -

852 Project Title : Storage stability of radurized fresh water fish *Tilapia mossambica*.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Sherekar, S.V. and others.  
 Description : Storage characteristics of radurized *Tilapia mossambica* was investigated in terms of microbial and enzymic alterations. Irradiated fish stored at 0-2 C showed acceptability consistently up to 40-50 days. Microbial population of unirradiated fresh fish was diverse but predominance of *Pseudomonas*, *Aeromonas* and *Vibrio* was observed at the time of complete spoilage. *Micrococcus*, *Flavobacterium* and *Alcaligenes* formed the major survivors as a result of irradiation. Activity of a major proteolytic enzyme,



cathepsin D and products of proteolysis were much less in deskinmed fish than in skin-on fish.

Report(s) : -  
Papers Published : -

853 Project Title : Preparation, frozen storage and utilisation of picked marine fish meat.  
Organisation : Central Food Technological Research Institute, Experiment Station, Mangalore 575 001.  
Project Category : Applied.  
Cost : Rs. 38,868/-  
Duration : October 1978-September 1979.  
Sponsor(s) : Institute.  
Investigator(s) : Revankar, G.D.; Baliga, B.L.  
Description : Organoleptic ratings and laboratory analysis for few biochemical and other parameters were carried out in respect of some stored fish samples. The study on holding cat fish at different temperatures indicated that for preparing good quality minced meat, the fish may be kept up to 14 hrs at ambient temperature, 3 days at refrigerated storage and 5 days at chill storage without ice. On 0, 5th and 8th day of storage showed that quality and percent yield decreased as the storage period increased. The storage stability of the picked meat held for different periods at different temperatures indicated that it can be stored at ambient temperature for 6 hours, 2 days at refrigerated, 4 days at chill storage and up to six months at frozen storage. Study of the effect of packing material on stability of frozen minced meat was also taken up.

Report(s) : Consolidated report.  
Papers Published : -

854 Project Title : Preparation and properties of fish protein concentrate (FPC).  
Organisation : Bhabha Atomic Research Centre, Bombay.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Centre.  
Investigator(s) : Warriar, S.B.; Ninjoor, V.  
Description : A process involving gamma-irradiation and heat treatment for the preparation of fish protein concentrate (FPC) from Bombay duck was developed. The procedure enabled the precipitation of 75% of proteins from Bombay duck muscle which accounted for 80% of myofibrillar proteins. The preparation displayed good functional and nutritional properties.

Report(s) : -  
Papers Published : 1. Warriar, S.B. and Ninjoor, V. Fish protein concentrate (FPC) from Bombay duck isolated by radiation heat combination procedure: Functional and nutritional properties. J. Food Sci. 46; 1981; 234

855 Project Title : Development of ready-to-use products from fish stabilised at room temperature.  
Organisation : Central Food Technological Research Institute, Mysore-570013; Meat, Fish and Poultry Technology Discipline.  
Project Category : Applied.  
Cost : Rs. 47,100/-.  
Duration : June 1980-March 1982.  
Sponsor(s) : Institute.

- Investigator(s) : Nair, R.B.; Girija Menon, A.V.  
 Description : Dry cutlet mix from cheap, bony varieties of fish with binding and flavour ingredients was prepared by thermal processing for conditioning, and suitable drying and mixing procedures. The product which could be reconstituted for making cutlets had good storage stability. A spiced fish powder was developed where oxidative rancidity was arrested by natural ingredients. The effectiveness of Garcinia cambogia (Malabar Tamarind) as an antioxidant was confirmed in products like fish powder, fish meal, fish curry mix, fish pickle and salted fish through storage studies. The effect was attributed to Garcinol present in the fruit.
- Report(s) : -  
 Papers Published : -
- 856 Project Title : Field data on marketability of read-to-use frozen marine fish products.  
 Organisation : Central Food Technological Research Institute, Fish Technology Experiment Station, Mangalore.  
 Project Category : Applied.  
 Cost : Rs. 1,00,000/-.  
 Duration : December 1983-June 1985.  
 Sponsor(s) : Laboratory.  
 Investigator(s) : Sripathy, N.V. and others.  
 Description : The feasibility of production of frozen marine fish products viz. fish curries, fish fingers, fish sticks and fish cutlets are being explored. Efforts are also on hand to obtain market response, to generate consumer response data through sales in retail outlet in selected cities, and to evaluate and improve the chances for transfer of technical know-how from laboratory stage to application in industry.
- Report(s) : -  
 Papers Published : -
- 857 Project Title : Identification of irradiated fish employing the activity of lysosomal enzyme as the index.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Gore, M.S. and others.  
 Description : A method was established to identify irradiated fish on the basis of an increase in the activity of acid phosphatase and N-acetyl  $\beta$ -glucosaminidase from press juice of fish muscle subjected to irradiation as compared to that of fresh unirradiated fish. It has been demonstrated that a variety of irradiated fish species such as *Tilapia mossambica*, Bombay duck, pomfret and shrimp could be detected employing this method.
- Report(s) : -  
 Papers Published : -
- 858 Project Title : Bacteriological survey of fish processing units in Calicut region.  
 Organisation : Fisheries Technological Station, Calicut 673 005.



- Project Category : Applied.  
 Cost : -  
 Duration : 1970-  
 Sponsor(s) : Government of Kerala, Directorate of Fisheries.  
 Investigator(s) : -  
 \*629
- 859 Project Title : Development of improved techniques for preservation and packaging of commercially important fishes.  
 Organisation : Central Institute of Fishery Technology, Matsyapuri, Cochin 682 029.  
 Project Category : Applied.  
 Cost : Rs. 4,03,500/-.  
 Duration : 1975-1980.  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Perigreen, P.A. and others.  
 \*630
- 860 Project Title : Studies on the iced preservation of fish landed at Cape comorin.  
 Organisation : Fisheries Technological Station; Fisheries Technological Sub-Station, Cape Comorin 620 702.  
 Project Category : Applied.  
 Cost : Rs. 75,000/- per annum.  
 Duration : 1977-1979.  
 Sponsor(s) : Government of Tamil Nadu, Fisheries Department.  
 Investigator(s) : Durairaj, S.; Shivagurunathan, P.  
 \*635
- 861 Project Title : Studies on the efficiency of icing and storage of fish at Tamil Nadu Fisheries Development Corporation Ltd., Tuticorin.  
 Organisation : Fisheries Technological Station, North Beach Road, Tuticorin 628 001.  
 Project Category : Applied.  
 Cost : Rs. 10,000/-.  
 Duration : March 1977-June 1979.  
 Sponsor(s) : Government of Tamil Nadu, Fisheries Department.  
 Investigator(s) : Durairaj, S. and others.  
 \*636
- 862 Project Title : Acid hydrolases and shelf stability of flesh foods.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Doke, S.N. and others.  
 Description : The mediation of acid hydrolyses in the spoilage of fish muscle during storage was evaluated by examining the levels of these enzymes as well as their autolytic end products in muscle of Bombay duck and Tilapia mossambica.  
 Report(s) : -  
 Papers Published : -

- 863 Project Title : Function of hydrolase in spoilage of fish and meat.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost :  
 Duration :  
 Sponsor(s) : Centre.  
 Investigator(s) : Harikumar, P. and others.  
 Description : Hydrolases of lysosomal origin in fish and meat are concerned with autolytic degradation of the tissue. A method has been developed to evaluate free and bound activities of the enzymes like cathepsin D, beta-glucuronidase, phosphatase, acid ribonuclease and N-acetyl beta-glucosaminidase using finely minced tissue-slices. Hydrolases in chicken and fish skeletal muscle were latent to the extent of 60-80%. Mitochondrial lysosomes rich particles which were purified 4-6 fold over muscle homogenates could be isolated from chicken and *Tilapia mossambica* by suitable modification of homogenisation and fractionation procedures.  
 Report(s) : -  
 Papers Published : -
- 864 Project Title : Studies on semi-commercial trials on the use of paraben-ice for fish preservation.  
 Organisation : University of Agricultural Sciences; College of Fisheries Mangalore 575 001; Department of Fish Processing Technology.  
 Project Category : Applied.  
 Cost : Rs. 3,000/-.  
 Duration : October 1981-September 1982.  
 Sponsor(s) : UAS, Bangalore.  
 Investigator(s) : Rudra Setty, T.M. and others.  
 Description : The use of propyl paraben-ice for the preservation of fresh fish on a semi-commercial scale, the problems related to large scale handling of fish, and the use of suitable packaging containers for fish are being investigated.  
 Report(s) : -  
 Papers Published : -
- 865 Project Title : Studies on the storage characteristics of fresh water fish during storage and transportation.  
 Organisation : Government of Tamil Nadu, Department of Fisheries, Fisheries By-Product Unit, Nagapattinam, Tamil Nadu.  
 Project Category : Applied.  
 Cost : Rs. 46,000/- per annum.  
 Duration : June 1981-May 1983.  
 Sponsor(s) : Government of Tamil Nadu.  
 Investigator(s) : Durairaj, S.; Krishnamurthy, S.  
 Description : The project aims to study the characteristic changes (organoleptic, chemical, bacteriological) in fresh water fish during cold storage and also during transportation to assess their keeping quality, and to evolve techniques to arrest spoilage to improve the market value of the fish. Studies on the iced preservation of flying fish have been completed.  
 Report(s) : -  
 Papers Published : -
- 866 Project Title : Canning techniques for fish and shell fish.  
 Organisation : Central Institute of Fisheries Technology, Matsyapuri, Cochin 682 029  
 Project Category : Applied.



Cost : Rs. 8,31,000/-.  
 Duration : January 1975-December 1980.  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Balachandran, K.K. and others.  
 \*638

- 867 Project Title : Deskinning of fish for extended storage.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Doke, S.N. and others.  
 Description : As fish skin is rich in hydrolytic enzymes, the effect of deskinning on storage characteristics of fish muscle was examined. Deskinning of Tilapia mossambica fillets stored at 0-4 C were acceptable till 3 weeks while fish fillets packed skin-on produced off-odours beyond 10 days. This was due to progressive release by cathepsin-D and hydrolytic end products in skinned fillets which occurred to a lesser extent in deskinning muscle. Combination treatments with nitrite and heat at 50 C caused maximum inhibition of cathepsin-D, aryl sulphatase and beta-glucuronidase activities.  
 Report(s) : -  
 Papers Published : -
- 868 Project Title : Blanching and NaCl treatment of fish.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Doke, S.N. and others.  
 Description : Cathepsin D was stable at 60 C for 2 hours when incubated along with substrate. In the absence of substrate, however, 70% of enzyme activity was lost when heated at 60 C for 10 min. Similarly beta-glucuronidase was stable at 60 C for 1 hr. At 70 C, however, 50% inactivation was observed both with and without substrate. Blanching of fish at 60, 70 and 80 C for 5, 10 and 15 min. could inactivate cathepsin D. NaCl was also observed to inhibit autolytic enzymes.  
 Report(s) : -  
 Papers Published : -
- 869 Project Title : Use of aluminium cans for canning of shrimp, oil sardine, mackerels and other important varieties.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Meat, Fish and Poultry Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 52,000/-.  
 Duration : September 1978-October 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Moorjani, M.N.; Puttarajappa, P.  
 Description : Oil sardine in oil and shrimp in brine canned using dingley cans of tin plate and aluminium kept well for 6 months (temperature around 2 C) while fish canned in tin plate cans showed some bitterness. The tin plate was tarnished particularly at the corner and the lacquer got peeled off. Round cans (301x 109) used with shrimp in brine showed blackening of the tin

plate at the soldering point. Iron and tin content of fish from such cans were also estimated.

Report(s) : Final.  
Papers Published : -  
\*688

870 Project Title : Improvements in curing of fish and fishery products.  
Organisation : Central Institute of Fisheries Technology, Matsyapuri, Cochin 682 029.  
Project Category : Applied.  
Cost : Rs. 1,63,000/-.  
Duration : January 1975-December 1979.  
Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
Investigator(s) : Devadasan, K. and others.  
\*637

871 Project Title : Survey on the quality criteria of fish and fishery products.  
Organisation : Central Institute of Fisheries Technology, Matsyapuri, Cochin 682 029.  
Project Category : Applied.  
Cost : Rs. 1,75,100/-.  
Duration : January 1973-December 1980.  
Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
Investigator(s) : Mathen, C. and others.  
\*639

872 Project Title : Evaluation of quality of marine fish and fish products as marketed internally.  
Organisation : Central Food Technological Research Institute, Mysore-570013.  
Project Category : Applied.  
Cost : Rs. 1,56,000/-.  
Duration : July 1981-June 1983.  
Sponsor(s) : Institute.  
Investigator(s) : Sripathy, N.V.; Balasaraswathi, M.  
Description : Several samples of commercial fish products comprising cured fish, canned fish and bottled fish pickles were procured from the local market in Mangalore and analysed by various physico-chemical and organoleptic parameters of quality. The results show wide variation in quality. The risk to the consumer by way of purchasing poor quality products is very high especially in canned and bottled products. There is need for a system of quality inspection and certification to safeguard consumers interest.  
Report(s) : -  
Papers Published : -

873 Project Title : Investigations on the nature of the microflora of fishes and development of national collection of marine and aquatic bacteria.  
Organisation : Central Institute of Fisheries Technology, Matsyapuri, Cochin 682 029.  
Project Category : Applied.  
Cost : Rs. 1,40,500/-.  
Duration : January 1976-December 1979.  
Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
Investigator(s) : James, M.A. and others.  
\*646



- 874 Project Title : Investigations on food poisoning organisms in fishery products.  
 Organisation : Central Institute of Fisheries Technology, Matsyapuri, Cochin 682 029.  
 Project Category : Applied.  
 Cost : Rs. 66,500/-.  
 Duration : January 1975-December 1979.  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Gopalkrishna Iyer, T.S. and others.  
 \*647
- 875 Project Title : Studies on growth promoting hormones in fish and their biochemical evaluation.  
 Organisation : Central Institute of Fisheries Technology, Matsyapuri, Cochin 682 029.  
 Project Category : Applied.  
 Cost : Rs. 1,93,200/-.  
 Duration : January 1978-December 1979  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Antony, P.D. and others.  
 \*652
- 876 Project Title : Investigation on the lipids of Indian fishes.  
 Organisation : Bose Institute, 93/1, Acharya P.C. Road, Calcutta 700 009.  
 Project Category : Exploratory.  
 Cost : Rs. 7,500/- year  
 Duration : 1975-1982.  
 Sponsor(s) : Institute.  
 Investigator(s) : Jyotirmoy Dutta and others.  
 \*653
- 877 Project Title : Effect of wood smoke on the preservation of oil sardine (Sardinella longiceps).  
 Organisation : University of Agricultural Sciences; College of Fisheries, Mangalore 575 001.  
 Project Category : Applied.  
 Cost : Rs. 10,000/-  
 Duration : January 1981-June 1983.  
 Sponsor(s) : UAS, Bangalore.  
 Investigator(s) : Chandrasekhar, T.C.  
 Description : The project intends to preserve the oily fish by hot smoking method and to analyse the responsible components of wood smoke for preservation and to isolate the surviving micro-organisms after wood smoke processing.  
 Report(s) : -  
 Papers Published : -
- 878 Project Title : Edible fish meal.  
 Organisation : Fisheries Technological Station, Calicut 673 005.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1974-  
 Sponsor(s) : Government of Kerala, Directorate of Fisheries.  
 Investigator(s) : -  
 \*654
- 879 Project Title : Packaging of fried fish in cans under CO<sub>2</sub>.  
 Organisation : Fisheries Technological Station, North Beach Road, Tuticorin 620 001  
 Project Category : Applied.

- Cost : Rs. 70,000/-.
- Duration : June 1977-June 1979.
- Sponsor(s) : Government of Tamil Nadu, Fisheries Department.
- Investigator(s) : Durairaj, S. and others.
- \*657
- 880 Project Title : Diversification of canned fishery products.
- Organisation : University of Agricultural Sciences; Fisheries College, Mangalore 575 001.
- Project Category : Applied.
- Cost : Rs. 5,000/-.
- Duration : 1976-1979.
- Sponsor(s) : University.
- Investigator(s) : Shantha Rama Rai, B. and others.
- \*660
- 881 Project Title : Studies on the quick salting of fish.
- Organisation : Fisheries Technological Station; Fisheries Technological Substation, Cape Comorin 629 702.
- Project Category : Applied.
- Cost : Rs. 7,500/- per annum.
- Duration : 1977-1979.
- Sponsor(s) : Government of Tamil Nadu, Fisheries Department.
- Investigator(s) : Durairaj, S.; Shivagurunathan, P.
- \*678
- 882 Project Title : Feasibility trials with radurised fresh water fish.
- Organisation : Bhabha Atomic Research Centre, Bombay 400 085.
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : Centre.
- Investigator(s) : Ghadi, S.V. and others.
- Description : Three consignments of fresh water fish received from Calcutta in iced condition were exposed to gamma irradiation (100 and 200 krad) and despatched back to Calcutta in iced condition. Analysis of samples at 0-2 C revealed that control samples were unacceptable by the 12th day. The irradiated samples, however, were acceptable for 20-24 days. The samples were also evaluated for TBC, TVA, TVBN and FFA during storage at 0-2 C.
- Report(s) : -
- Papers Published : -
- 883 Project Title : Utilization of trash fish.
- Organisation : Bhabha Atomic Research Centre, Bombay 400 085
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : Centre.
- Investigator(s) : Ghadi, S.V. and others.
- Description : Minced muscle of several trash fish obtained on deboning and dressing could be readily converted into fish muscle blocks or rolls for subsequent utilisation as sausages, fish sticks, fish cakes and other traditional fish products. Addition of tripolyphosphate and NaCl improved textural stability of fish rolls and blocks. Gamma irradiated (100 Krad) minced muscle blocks and rolls were acceptable for 25-35 days at 0-2 C as compared with 5-7 days for unirradiated samples, thus pointing out to four-fold enhancement of storage life.



Mechanical deboning increased protein extractability of the products with concomitant increase in the emulsifying capacity. Fish paste and fish sausages had high sensory rating.

Report(s) : -  
Papers Published : -

884 Project Title : Fish cathepsin enzymes.  
Organisation : Bhabha Atomic Research Centre, Bombay.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Centre.  
Investigator(s) : Gore, M.S.; Ninjoor, V.  
Description : Cathepsin A, B and D were detected in Bombay duck drip. Cathepsin D was also detected in pomfret, shrimp and Tilapia mossambica. The role of these enzymes in accomplishing proteolysis of fish skeletal muscle is being investigated.  
Report(s) : -  
Papers Published : -

885 Project Title : Utility of mud skippers of Gujarat.  
Organisation : Marine Biological Research Station, Pork Okha 361 350.  
Project Category : Applied.  
Cost : -  
Duration : 1976-  
Sponsor(s) : Government of Gujarat, Department of Fisheries.  
Investigator(s) : Chhaya, N.D. and others.  
\*679

886 Project Title : Seasonal changes in the fat content of flesh of Indian major carps under different ecological conditions.  
Organisation : Central Inland Fisheries Research Institute; Fresh Water Fish Culture Station, Bhubaneswar, Orissa.  
Project Category : Applied.  
Cost : Rs. 10,000/- per annum.  
Duration : April 1977-July 1980.  
Sponsor(s) : Institute.  
Investigator(s) : Tripathy, N.K.; Sinha, V.R.P.  
\*668

887 Project Title : Chilling of fish : Iced preservation of flying fish and crab  
Organisation : Fisheries Technological Station; Fisheries Byproduct Unit, Nagapattinam 611 001.  
Project Category : Applied.  
Cost : Rs. 15,000/-.  
Duration : July 1977-July 1979.  
Sponsor(s) : Government of Tamil Nadu, Fisheries Department.  
Investigator(s) : Durairaj, S.; Singarayan, V.  
\*669

888 Project Title : Seasonal variation in lipid content and its constituents in the liver of cat fish.  
Organisation : University of Agricultural Sciences, College of Fisheries, Matsyanagar, Mangalore 575 002.  
Project Category : Applied.  
Cost : Rs. 5,000/-.  
Duration : September 1980-December 1982  
Sponsor(s) : University of Agricultural Sciences, Bangalore.  
Investigator(s) : Srikar, L.N.

- Description : The project is concerned with: (1) study of seasonal variation in the total lipid content of liver, (2) Fractionation of the total lipids into phospholipids and neutral lipids and characterise them; and (3) extraction of liver oil and study its nutritive and keeping quality.
- Report(s) : Interim.
- Papers Published : -
- 889 Project Title : Purification of Bombay duck  $\beta$ -glucuronidase.
- Organisation : Bhabha Atomic Research Centre, Bombay.
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : Centre.
- Investigator(s) : Warriar, S.B.; Ninjoor, V.
- Description : In order to evolve process parameters for the preservation of Bombay duck, it has been found necessary to suppress the action of several hydrolytic enzymes including that by the heat stable enzyme  $\beta$ -glucuronidase. This enzyme was purified 125 fold with 20% recovery by affinity chromatography over saccharo 1,4 lactone bound sepharose 4B. The homogeneity of the enzyme was ascertained by gel electrophoresis. The enzyme having a molecular weight of 1,60,000 was shown to be a glycoprotein. The enzyme was characterized.
- Papers(s) : -
- Papers Published : -
- 890 Project Title : Survey of estuarine mullet resources of Dakshina Kannada District.
- Organisation : University of Agricultural Sciences; College of Fisheries, Mathsyanganagar, Mangalore 575 002.
- Project Category : Survey.
- Cost : Rs. 2360/-.
- Duration : October 1981-October 1983.
- Sponsor(s) : University.
- Investigator(s) : Shanbhogue, S.L.
- Description : Mulletts are important food fishes of high commercial value. Resources of these fish in the Netravathi, Gurpur, Mulki, Udyavar and Gangolli estuaries of Dakshina Kannada District are being surveyed.
- Report(s) : -
- Papers Published : -
- 891 Project Title : Drawing up standards for processing Beche-de-mer.
- Organisation : Government of Tamil Nadu, Department of Fisheries, Fisheries Technological Station, North Beach Road, Tuticorin 628 001.
- Project Category : Applied.
- Cost : Rs. 37,000/-.
- Duration : June 1981-May 1983
- Sponsor(s) : Government of Tamil Nadu.
- Investigator(s) : Durairaj, S.; Inbaraj, S.
- Description : The Beche-de-mer industry is specific to Mandapam region of Tamil Nadu and the entire quantity is exported to Far East. This project aims to study the methods of processing, grading and packing of Beche-de-mer in order to lay down standards for quality products.
- Report(s) : -
- Papers Published : -



- 892 Project Title : Studies on dry salted ribbon fish and tuna.  
 Organisation : Fisheries Technological Sub Station, Cape Comerin 629 702.  
 Project Category : Applied.  
 Cost : Rs. 14,400/-.  
 Duration : July 1981-1983.  
 Sponsor(s) : Department of Fisheries, Government of Tamil Nadu.  
 Investigator(s) : Durairaj, S.; Singarayan, V.  
 Description : The project aims to improve curing methods of ribbon fish and tuna and to process the ribbon fish into laminated forms. Investigations have also been conducted employing different salting methods and using different packing materials.  
 Report(s) : -  
 Papers Published : -
- 893 Project Title : Studies on qualitative and quantitative chemical changes in gamma irradiated mackerel fish.  
 Organisation : Bhabha Atomic Research Centre, Bombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Bandyopadhyay, C.; Rao, B.Y.K.  
 Description : Changes in lipid composition of unirradiated and gamma-irradiated (150 krad) in Indian mackerel were investigated during storage at 0-2 C and 10 C respectively. Irrespective of storage temperature and gamma irradiation, peroxide value and free fatty acids content increased during storage. Fatty acid composition of unirradiated and irradiated fish lipids, analysed by gas liquid chromatography, indicated a decrease in polyunsaturated fatty acids during storage. Volatile fish flavour compounds from both the samples were isolated by distillation-extraction technique and analysed by gas liquid chromatography. There was no detectable change in the volatile components of irradiated samples as compared to unirradiated samples. Salting and sun-drying of mackerel fish caused considerable decrease in polyenoic fatty acids.  
 Report(s) : IAEA-TEC DOC-256, IAEA, Vienna, 1981.  
 Papers Published : Rao, B.Y.K. and Bandyopadhyay, C. Changes in lipid composition of radurized Indian mackerel (*Rastrelliger kanagurta*) during refrigerated storage, *Die Fleischwirtschaft*, 1981 (in press).
- 894 Project Title : Studies on the canning of Indian mackerel tuna (*Euthynnus affinis*).  
 Organisation : University of Agricultural Sciences; College of Fisheries, Mangalore 575 001; Department of Fish Processing and Technology.  
 Project Category : Applied.  
 Cost : Rs. 2,000/-.  
 Duration : April 1981-December 1982.  
 Sponsor(s) : UAS, Bangalore.  
 Investigator(s) : Nagaraj, A.; Saralaya, K.V.  
 Description : The canning procedure for Indian mackerel tuna are standardized and high quality products from the fish are being evolved. Experiments are being conducted to decide the appropriate pack form for canning, such as solid pack, large chunks, small chunks and flakes; to study the most suitable method of pre-cooking and their relationship to product quality; to compare skin removal by lye peeling and manual operation; and to conduct heat preservation tests on the different forms of pack.

The canned products are tested periodically for about 6 months after production, for physical, chemical and organoleptic quality characteristics.

- Report(s) : -  
Papers Published : -
- 895 Project Title : Comparative oxidative changes in mackerel processed by different methods.  
Organisation : Bhabha Atomic Research Centre, Bombay.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Centre.  
Investigator(s) : Ghadi, S.V. and others  
Description : Oxidative deterioration in radurised mackerel have been compared to that of mackerel processed by other methods such as sun drying. Radurisation did not cause excessive oxidative deterioration so as to affect the quality attributes.
- Report(s) : -  
Papers Published : -
- 896 Project Title : Radurisation of mackerel.  
Organisation : Bhabha Atomic Research Centre, Bombay.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Centre.  
Investigator(s) : Venugopal, V. and others.  
Description : Radurisation extends shelf life of mackerel which is short even at ice temperature. The optimum dose employed was 150 krad. Time-temperature-tolerance of radurised samples stored at temperatures between 0-20 C indicated that they showed no significant increase in TBC, TVA and FFA during storage at elevated temperature only. The progressive increase of TVBN as in control samples (where all the above progressively increased as a function of temperature with good correlation with OS) could be attributed to shifts in microbial profile. The radurised samples exhibited better textural properties. Reduction in shear force, water holding capacity and plasticity index during storage at 0-2 C were comparable in control samples and radurised samples kept for 10 days and for 20 days respectively.
- Report(s) : -  
Papers Published : 1. Venugopal, V. and others. Extension of shelf-life of Indian mackerel (*Rastrelliger kanagurta*) by gamma radiation. J. Fish Res. Board of Canada 30; 1973; 305  
2. Venugopal, V. Stability of proteins in radurized Indian mackerel: physico-chemical evaluation. J. Food Biochem. 5; 1981; 145  
3. Venugopal, V. and others. Volatile acid content as a quality index for Indian mackerel. Lebensm.wiss.Technol. 14; 1981; - 39  
4. Venugopal, V. and others. Time-temperature-tolerance of radurized Indian mackerel. J. Food Protection (In press).  
5. Gadhi, S.V. and Lewis, N.F. Textural stability of radurized Indian mackerel. J. Food Sci and Tech. 16; 1979; 226  
6. Gadhi, S.V. and others. Studies on the storage stability and feasibility of radurization of Indian mackerel (*Rastrelliger kanagurta*). Food Preservation by Irradiation Vol.I pp.305-320, International Atomic Energy Agency, 1978.



- 897 Project Title : Microflora of radurized Indian mackerel (*Rastrelliger kana-gurta*).
- Organisation : Bhabha Atomic Research Centre, ,Bombay.
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : Centre.
- Investigator(s) : Alur, M.D.; Lewis, N.F.
- Description : Initial microflora of unirradiated Indian mackerel gained predominance at 15 C. *Micrococcus* (56%) and *Bacillus* (40%) comprised the major microflora at 20 C. In radurised mackerel, *Micrococcus* (83%) maintained predominance during storage at 0, 5 and 10 C. However *Micrococcus* (47%) and *Bacillus* (48%) constituted major microflora at 15 C while *Bacillus* comprised 72% of the total microflora at 20 C. Results indicate higher doses (90 krad of gamma irradiation and 9000 ergs/mm<sup>2</sup> of UV irradiation) are required for 90% inactivation.
- Report(s) : -
- Papers Published : 1. Alur, M.D. and Lewis, N.F. Influence of storage temperature on microflora on Indian mackerel. *Die Fleischwirtschaft*. 60; 1980; 453
- 898 Project Title : Transportation studies on radurised mackerel.
- Organisation : Bhabha Atomic Research Centre, Bombay.
- Project Category : Applied.
- Cost : -
- Duration : -
- Sponsor(s) : Centre and Jadhavpur University, Calcutta.
- Investigator(s) : Ghadi, S.V. and others.
- Description : Fresh mackerel were dressed, air packed in polyethylene bags and irradiated at 150 krad and then packed with three times their weight of ice in plywood boxes (60 x 50 x 40 cm) lined by 20 mm thermocole, and despatched from Bombay to Calcutta (about 2000 km) by rail. Periodical examination of samples for chemical, bacterial and organoleptic quality indicated no changes attributable to transport.
- Report(s) : -
- Papers Published : -
- 899 Project Title : Study of heat penetration pattern and thermal process requirements of diversified canned fish products.
- Organisation : Universtiy of Agricultural Sciences; Fisheries College, Mangalore 575 001.
- Project Category : Applied.
- Cost : Rs. 4,500/-.
- Duration : 1976-1979.
- Sponsor(s) : University.
- Investigator(s) : Saralaya, K.V.
- \*661
- 900 Project Title : Investigation of microbiological spoilage in canned fish sausage.
- Organisation : University of Agricultural Sciences; College of Fisheries, Mangalore 575 001; Department of Fish Processing Technology.
- Project Category : Applied.
- Cost : Rs. 2,000/-.
- Duration : July 1981-March 1983.
- Sponsor(s) : UAS, Bangalore.
- Investigator(s) : Saralaya, K.V. and others.

- Description : The project is concerned with the investigation of the pattern of viable spoilage organisms in the processed canned fish sausage, isolation and identification of the causative organism and also exploration of the source of contamination.
- Report(s) : -
- Papers Published : -
- 901 Project Title : Quality evaluation of Massmin of Mangalore fish market.
- Organisation : University of Agricultural Sciences; College of Fisheries, Mangalore 575 001.
- Project Category : Applied.
- Cost : Rs. 1,000/-.
- Duration : October 1981-September 1982.
- Sponsor(s) : UAS, Bangalore.
- Investigator(s) : Sudhakara, N.S.; Chandrasekar, T.C.
- Description : The quality of Massmin (a traditional product from tuna) available in Mangalore fish market by chemical and microbiological methods and suggestions for the improvement of the product are given. In addition, studies on the preparation of Massmin by standardized methods are also under taken.
- Report(s) : -
- Papers Published : -
- 902 Project Title : Evaluation of different fillers for use in the preparation of fish sausage.
- Organisation : University of Agricultural Sciences; College of Fisheries, Mangalore 575 001; Department of Fish Processing Technology.
- Project Category : Applied.
- Cost : Rs. 1,000/-.
- Duration : 1981-1983.
- Sponsor(s) : UAS, Bangalore.
- Investigator(s) : Matalik Desai, T.S. and others.
- Description : The possibility of using corn flour and wheat flour as fillers in the manufacture of fish sausage is being assessed.
- Report(s) : -
- Papers Published : -
- 903 Project Title : Canning of fish balls.
- Organisation : University of Agricultural Sciences; College of Fisheries, Mangalore 575 001; Department of Fish Processing Technology.
- Project Category : Applied.
- Cost : Rs. 2,000/-.
- Duration : October 1979-September 1982.
- Sponsor(s) : UAS, Bangalore.
- Investigator(s) : Haridas Bhandary, M. and others.



## Shell fish and Molluses

- 904 Project Title : Development of Aquaculture in coastal area of Saurashtra.  
 Organisation : Gujarat Fisheries Aquatic Sciencies Research Institute, Okha.  
 Project Category : Survey and Applied.  
 Cost : Rs.1,11,000/-.  
 Duration : Continuous  
 Sponsor(s) : Department of Fisheries, Government of Gujarat.  
 Investigator(s) : Chhaya, N.D. and others.  
 Description : The projects aims to culture varieties of prawns, shell fish crabs and demonstrate the aquaculture activities to the fishermen of the area.
- 905 Project Title : Culture of prawn *Penaeus indicus*.  
 Organisation : Annamalai University; Centre of Advanced Study in Marine Biology, Parangipettai 608 502.  
 Project Category : Applied.  
 Cost : Rs. 45,000/-.  
 Duration : December 1976-December 1979.  
 Sponsor(s) : University Grants Commission, New Delhi; and University.  
 Investigator(s) : Natarajan, R. and others.  
 \*682
- 906 Project Title : Use of chilled seawater in handling and processing of prawns.  
 Organisation : University of Agricultural Sciences; College of Fisheries, Mangalore 575 002.  
 Project Category : Applied.  
 Cost : Rs. 5,500/-.  
 Duration : September 1981-September 1982  
 Sponsor(s) : Karnataka State Council for Science and Technology.  
 Investigator(s) : Karunasagar, I.  
 Description : The quality of frozen prawnshandled, transported and processed in chilled sea water is being evaluated. Presently prawns are being iced only after landing and this naturally results in considerable loss of quality. If they are handled and iced on board the vessel, the spoilage can be prevented. This will be confirmed by microbiological, biochemical and organoleptic tests.  
 Report(s) : -  
 Papers Published : -
- 907 Project Title : Chemical treatment for drip loss prevention: Detailed investigations for clearance by regulatory agencies.  
 Organisation : Central Food Technological Research Institute, Mysore-570013;  
 Project Category : Applied.  
 Cost : Rs. 34,000/-.  
 Duration : June 1981-October 1981.  
 Sponsor(s) : Institute.  
 Investigator(s) : Godavari Bai, S.; Khabade, V.S.  
 Description : Commercial samples of prawns of known history were purchased at the landing centre, Mangalore, and were given dip treatment in sodium citrate (8% solution for 5 minutes). The untreated samples and the treated samples were frozen stored (-20 C) after analysis for the levels of sodium citrate for 16 weeks. The average uptake of sodium citrate immediately after treatment was found to be 830 mg per 100 g and the frozen stored samples had citrate level of about 900 mg/100 g. The observed difference could be attributed to the weight difference between the unfrozen and frozen stored samples.  
 Report(s) : -  
 Papers Published : -

- 888 Project Title : Studies on the effective use of polyphosphate to prevent loss of weight in frozen shrimp.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Meat, Fish and Poultry Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 25,500/-.  
 Duration : April 1978-January 1979  
 Sponsor(s) : Institute.  
 Investigator(s) : Godavari Bai, S.; Khabade, V.S.  
 Description : The aim of the project was to study the frozen storage characteristics of prawn meat treated with sodium tripolyphosphate, at levels lower than that recommended in the literature, in order to prevent loss of weight in frozen shrimp. Additional data were collected, investigating the effect of the use of the polyphosphate on frozen storage of prawns, which had been stored in ice for a few days prior to the freezing.  
 Report(s) : -  
 Papers Published : -  
 \*690
- 909 Project Title : Bench scale production of bactopectone from shrimp head waste.  
 Organisation : Central Food Technological Research Institute, Mysore, 570013; Meat, Fish and Poultry Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 42,700/-  
 Duration : April 1978-April 1979  
 Sponsor(s) : Institute.  
 Investigator(s) : Rao, S.V.S.; Saraswati, S.  
 Description : Trials were carried out to scale up the laboratory process developed earlier. The process used in the trials was based on the use of phosphoric acid instead of hydrochloric acid to minimise the ash content, incorporation of EDTA and BHA in the material subjected to papain digestion to avoid darkening and extension of the process time to obtain a fully soluble product. The product obtained in the trial had better microbiological quality and had an essential amino acid composition comparable to oxid peptone. The product is economical to manufacture and conforms to ISI standards.  
 Report(s) : Final.  
 Papers Published : 1. Suryanarayana Rao, S.V. and others. Preparation and microbiological evaluation of bactopectone from shrimp waste. J. Food Sci. Technol. 17; 1980; 133.  
 \*691
- 910 Project Title : Relationship of bacterial pollution in clams and mussel and environmental indices.  
 Organisation : Fisheries Technological Station, Calicut 673 005.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1976-  
 Sponsor(s) : Government of Kerala, Directorate of Fisheries.  
 Investigator(s) : Ratnam Venugopal, N. and others.  
 \*686
- 911 Project Title : Amino acid estimation of clams and mussels.  
 Organisation : Fisheries Technological Station, Calicut 673 005.  
 Project Category : Applied  
 Cost : -  
 Duration : 1975-



Sponsor(s) : Government of Kerala, Directorate of Fisheries.  
 Investigator(s) : -  
 \*687

912 Project Title : Purification of oysters and mussels.  
 Organisation : Government of Tamil Nadu; Department of Fisheries, Fisheries Technological Station, North Beach Road, Tuticorin 628 001.  
 Project Category : Applied.  
 Cost : Rs. 43,000/-.  
 Duration : June 1981-May 1983.  
 Sponsor(s) : Government of Tamil Nadu.  
 Investigator(s) : Durairaj, S.; Syed Mohamed, M.  
 Description : Areas where mussels and oysters naturally occur and cultured are increasingly becoming polluted. Methods are therefore being developed to purify the meats of these bivalves so as to make them fit for consumption.  
 Report(s) : -  
 Papers Published : -

#### Food of microbial origin

913 Project Title : Investigation of baker's yeast production by unconventional methods.  
 Organisation : Britannia Biscuit Company Limited, 'Nirmal' 20th Floor, Nariman Point, Bombay 400 021; Research and Development Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : March 1978-February 1979  
 Sponsor(s) : Company.  
 Investigator(s) : Fernando, G.R.; Rao, G.R.  
 \*696

914 Project Title : Effectiveness of agitational fermentors for reducing costs in active dry baker's yeast production.  
 Organisation : Central Food Technological Research Institute, Fermentation Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 29,000/-.  
 Duration : November 1980-March 1981  
 Sponsor(s) : Institute.  
 Investigator(s) : Basappa, S.C. and others.  
 Description : Agitation at 280 rpm has been found to yield 24% more of bakers yeast (wet basis) than without agitation in 10L fermentor. The activity of the dried yeast from non-agitated culture was not satisfactory according to ISI specifications as compared to one from agitated culture, which gave quite satisfactory activity. The trehalose content of yeast from agitated culture was 3 times more than that of non-agitated culture indicating thereby the potential shelf life of the former. By changing the proportion of the media components and aeration rates, it has been possible to increase the conversion efficiency of yeast from 30 to 45% on sugar basis.  
 Report(s) : -  
 Papers Published : -

- 915 Project Title : Yeast based products.  
 Organisation : Cadbury India Limited, Cadbury House, Bhulabhai Desai Road, Bombay 400 026.  
 Project Category : Applied.  
 Cost : Rs. 3,00,000/-.  
 Duration : January 1976-January 1979.  
 Sponsor(s) : Company.  
 Investigator(s) : Shenoy, R.D. and others.  
 \*698
- 916 Project Title : Nutritional and toxicological studies with animals on petroleum yeast.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Biochemistry and Applied Nutrition Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,30,000/-.  
 Duration : January 1975-March 1980.  
 Sponsor(s) : CSIR  
 Investigator(s) : Venkat Rao, S. and others.  
 Description : Two batches of petroleum yeast received from an oil refinery were studied for major nutrients, essential amino acids and PER. There were no appreciable differences between the two batches. Petroleum yeast was a good source of lysine and threonine. The PER of both batches was 1.8 which could be increased to 3.0 by methionine supplementation. The sulphur amino acids were the major limiting amino acids. In toxicological studies, reproduction and lactation performances of petroleum yeast fed rats compared favourably with those fed casein. No differences were found with serum cholesterol levels, but, however, there was increased excretion of citric acid and allantoin in animals fed petroleum yeast.  
 Report(s) : Final.  
 Papers Published : -  
 \*699
- 917 Project Title : Cultivation and processing of algae as a source of single cell protein for use as feed and food.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Product Development and Design Discipline.  
 Project Category : Applied.  
 Cost : Rs. 5,00,000/-.  
 Duration : August 1976-December 1980.  
 Sponsor(s) : Government of India; National Committee on Science and Technology.  
 Investigator(s) : Ramanathan, P.K. and others.  
 Description : Pilot plant studies were conducted to cultivate and process green alga (*Scenedesmus acutus*) and blue green alga (*Spirulina platensis*) with the latter proving advantageous for developing a simplified method of production. Algal mass was filtered through cloth instead of centrifugation and dried in sun-light or a cross-flow drier instead of a drum drier. Two new cement tanks were constructed and used for the cultivation studies. It was found that chitosan, a cationic polymer obtained from squilla was an efficient flocculant for *Scenedesmus* sp. Outdoor culture and dried algae did not show any microbiological contamination. *Scenedesmus* showed hypcholesterolemic effect in rats. Suitable equipment were designed and fabricated. Cost of production was also calculated.



Report(s) : Final.

- Papers Published :
1. Anusuya Devi, M. and others. Extraction and isolation of the protein pigment complex in blue green alga (*Spirulina platensis*). Presented at Annual Meeting of Association of Biological Chemists (India), Lucknow, October 1979.
  2. Anusuya Devi, M. and others. Studies on the proteins of mass-cultivated blue green alga (*Spirulina platensis*). J. Agric. Food Chem. 29; 1981; 522
  3. Becker, W.E. and others. Digestability coefficient and biological value of proteins in the alga *Scenedesmus acutus* processed by different methods. Nutr. Rep. Int. 14(4); 1976; 457
  4. Becker, W.E. and others. Effect of different methods of processing on the protein efficiency ratio of the green alga *Scenedesmus acutus*. Nutr. Rep. Int. 14(3); 1976; 305
  5. Krishna Kumari, M.K. and others. Food safety evaluation: acute oral and dermal effects of alga *Scenedesmus acutus* and *Spirulina platensis* on albino rats. J. Food Process. Engineering, 44; 1981; 934.
  6. Mahadevaswamy, M. and Venkataraman, L.V. Microbial contaminants in algal cultures and processed powder for use in food. Presented at Second Indian Convention of Food Scientists and Technologists, Mysore, February 1981.
  7. Mahadevaswamy, M. and Venkataraman, L.V. Microbial load in mass cultures of green alga *Scenedesmus acutus* and its processed products. J. Biosci. 3; 1981; 439.
  8. Mahadevaswamy, M. and Venkataraman, L.V. Studies on the survival of inoculated pathogens in the cultures of alga *Spirulina platensis*. Presented at Annual Conference of Association of Microbiologists of India, Mysore, November 1982.
  9. Nigam, B.P. and Venkataraman, L.V. Application of Chitosan as a flocculent for the alga *Scenedesmus acutus*. Arch. fur Hydrobiol. 88(3); 1980; 378
  10. Subbalakshmi, G. and others. Effect of processing on the nutrient content of the green alga *Scenedesmus acutus*. Nutr. Rep. Int. 14(5); 1976; 581
  11. Venkataraman, L.V. and Shivashankar, S. Studies on extractability of proteins from alga *Scenedesmus acutus*. Arch. Hydrobiol. 56;(Suppl); 1979; 114
  12. Venkataraman, L.V. Critical appraisal of food and feed based on Indian experience. Presented at National Workshop on Algal systems, Indian Society of Biotechnology, IIT, Delhi, 1980.
  13. Venkataraman, L.V. Characterisation of bibiprotein of blue green alga with possibilities of utilising rural wastes in India. Presented at Annual Meeting of Society of Biological Chemists (India), Bangalore, December, 1980.
  14. Venkataraman, L.V. and others. Development of a rural system for the production of alga *Spirulina platensis* for utilisation on feeds. Presented at Second Indian Convention of Food Scientists and Technologists, Mysore, February 1981.
  15. Venkataraman, L.V. and others. Investigations on toxicology and safety of algal diets in albino rats. J. Food Cosmetic Toxicology, 18; 1980; 271
  16. Venkataraman, L.V. and others. Production technology of green alga *Scenedesmus acutus* with Indian perspectives. Biotech. Letters. 2; 1980; 467

17. Venkataraman, L.V. and others. Integrated approach for the production of blue green alga (*Spirulina platensis*) for the use in poultry feeds. Presented at Ahara 82: International Food Conference, Bangalore, May 1982.
18. Venkataraman, L.V. and others. Simplified method for raising inoculum of blue green alga *Spirulina platensis* for rural application in India. *Physiol.* 21: 1982, 1A.
19. Venkataraman, L.V. and others. Studies on the effect of blood and its constituents on the growth of the alga *Scenedesmus acutus* (to be published).
20. Venkataraman, L.V. and Becker, E.W. Biotechnology of algal production and its application. (to be published).

- 918 Project Title : Studies on isolation and characterisation of protein from algae.  
 Organisation : Harcourt Butler Technological Institute, Kanpur 208 002.  
 Project Category : Applied.  
 Cost : Rs. 20,000/-.  
 Duration : February 1976-1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Pandey, G.N.; Saxena, M.  
 \*702
- 919 Project Title : Utilisation of agricultural waste materials for feed and food production.  
 Organisation : Punjab Agricultural University, Ludhiana 141 004; Department of Microbiology.  
 Project Category : Applied.  
 Cost : -  
 Duration : April 1974-  
 Sponsor(s) : Punjab State Government  
 Investigator(s) : Kalra, M.S. and others.  
 \*703
- 920 Project Title : Production of fungal based products of industrial importance. 3. Production of microbial protein (biomass) by submerged culture method by utilising low grade agricultural and other wastes.  
 Organisation : Regional Research Laboratory, Canal Road, Jammu Tawi 180 001.  
 Project Category : Fundamental, Applied and Exploratory.  
 Cost : Rs. 2,30,000/-.  
 Duration : March 1975-March 1980.  
 Sponsor(s) : Laboratory.  
 Investigator(s) : -  
 \*704
- 921 Project Title : Exploration and development of useful agaricus: Selection and cultivation.  
 Organisation : National Botanic Gardens, 1, Rana Pratap Marg, Lucknow 226 001.  
 Project Category : Fundamental and Applied.  
 Cost : -  
 Duration : January 1963-December 1982.  
 Sponsor(s) : Organisation.  
 Investigator(s) : Pathak, N.C. and others.  
 \*705
- 922 Project Title : Cultivation of edible fungi.  
 Organisation : Himachal Pradesh University; College of Agriculture, Solan, Himachal Pradesh; Botany and Plant Pathology Department.  
 Project Category : Applied.



Cost : Rs. 20,00,000/-  
 Duration : September 1961-  
 Sponsor(s) : University.  
 Investigator(s) : Munjal, R.R. and others.  
 \*707

- 923 Project Title : Cultivation of protein rich edible mushrooms, through utilisation of agro-wastes.  
 Organisation : Regional Research Laboratory, Jorhat 785 006, Assam.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977-1978.  
 Sponsor(s) : Council of Scientific and Industrial Research.  
 Investigator(s) : Bordoloi, D.N.; Adhikary, R.K.  
 Description : The project aims at the utilization of spent grass of Java citronella, an essential oil bearing plant for growing protein rich mushrooms economically. Under ideal conditions, individual beds (4' x 4' approx) produce 4-6 kgs of mushrooms per cropping cycle which varies from 2 to 12 weeks for different species.  
 Report(s) : -  
 Papers Published : -
- 924 Project Title : Mushroom culture.  
 Organisation : Government Fruit Preservation and Canning, Institute, 18-B, Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : April 1980-April 1983.  
 Sponsor(s) : Government of Uttar Pradesh  
 Investigator(s) : Revis, B.; Shukla, K.G.  
 Description : The project is concerned with standardising a method of cultivation of Pleurotus sajor caju at Lucknow by supplementing chopped paddy straw with powders of different pulses.  
 Report(s) : -  
 Papers Published : -
- 925 Project Title : Studies on the cultivation of edible tropical mushrooms.  
 Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani 431 402; Department of Food Science and Technology.  
 Project Category : Applied.  
 Cost : Rs. 10,000/-,  
 Duration : June 1980-December 1983.  
 Sponsor(s) : University.  
 Investigator(s) : Pawar, R.E.; Khan, M.H.  
 Description : Locally grown edible mushrooms from Aurangabad region were studied for effect of substrates on yield of mushroom. The three substrates used were, jowar bhusa, banana leaves and paddy straw. The mushroom so cultivated will be studied for proximate composition and amino acid profile.  
 Report(s) : Two departmental reports.  
 Papers Published : -
- 926 Project Title : Studies on mushroom cultivation.  
 Organisation : TamilNadu Agricultural University; Agricultural College and Research Institute, Madurai 625 104; Plant Pathology Department.  
 Project Category : Applied.  
 Cost : Rs. 2,000/- per year.  
 Duration : March 1977-March 1980.

Sponsor(s) : University.  
 Investigator(s) : Doraiswamy, S.  
 #708

- 927 Project Title : Studies on Agaricus with special reference to cultivation of edible forms.  
 Organisation : Regional Forest Research Centre, Mandla Road, Jabalpur.  
 Project Category : Fundamental.  
 Cost : Rs. 500/ per annum.  
 Duration : 1979  
 Sponsor(s) : Forest Research Institute and Colleges, Dehradun.  
 Investigator(s) : Jamaluddin; Vasudev Singh Dadwal.  
 Description : Edible forms of mushrooms like Agaricus bisporus, Volvariella sp. Tricholome sp. and Pleurotus sajar-kaju are being successfully cultivated and analysed.  
 Report(s) : Quarterly, half yearly and Annual reports.  
 Papers Published : -
- 928 Project Title : A study on the chemical composition of some edible varieties of mushroom and their use as food for human beings.  
 Organisation : Udai Pratap College, Varanasi 221 002, Department of Animal Husbandary and Dairying.  
 Project Category : Exploratory.  
 Cost : Rs. 3,000/-.  
 Duration : 1980-1982.  
 Sponsor(s) : University Grants Commission.  
 Investigator(s) : Saraswat, B.L.  
 Description : The project aims to explore mushroom as a good source of protein to provide high quality of protein in human diet and to cultivate mushrooms at different climatic conditions.  
 Report(s) : -  
 Papers Published : -
- 929 Project Title : Studies on the maintenance of whiteness and extension of shelf life of cultivated and naturally occurring mushrooms by steeping and other methods of preservation.  
 Organisation : Central Food Technological Research Institute, Experiment Station, Ludhiana.  
 Project Category : Applied.  
 Cost : Rs. 9,200/-.  
 Duration : January 1979-June 1979.  
 Sponsor(s) : Punjab Agricultural University; Ludhiana, Microbiology Department.  
 Investigator(s) : Pruthi, J.S. and others.  
 Description : Fresh temperate mushrooms (Agaricus bisporus) grown in winter at PAU farm were preserved by several steeping techniques using different concentrations of citric acid, acetic acid, ascorbic acid, sulphur dioxide, etc. and were kept immersed in the respective solutions in screw-capped glass jars at room temperature. The preliminary observations showed that acidified solution containing suitable concentration of sulphur dioxide gave the best results in preserving the original whiteness of the fresh mushrooms as well as in the enhancing of their shelf-life by about 3-4 days. Water blanching gave better results than steam blanching in improving the colour as well as in enhancing the shelf life to about one week. Replacement of the old covering liquid with fresh liquid at the end of one week further enhanced the shelf life of mushrooms by 2-3 weeks. Thus fresh mushrooms could be preserved



for 5-6 weeks by the above techniques. Systematic microbiological examination for total viable count (TVC) of bacteria, yeast and mould revealed that about 50% of the microbial load was reduced in mere washing of mushrooms thoroughly.

930 Project Title : Technological utilization of Kashmir mushrooms.  
 Organisation : Regional Research Laboratory, Canal Road, Jammu Tawi 180 001.  
 Project Category : Applied.  
 Cost : Rs. 62,500/-.  
 Duration : July 1976-December 1984.  
 Sponsor(s) : Council of Scientific and Industrial Research.  
 Investigator(s) : Bhatia, A.K. and others.  
 Description : The project aims at the better utilization of mushroom crops by new preservation techniques. The process is intended to be scaled upto pilot plant level and its economy will also be worked out.  
 Report(s) : -  
 Papers Published : Dang, R.L. and Singh, R.P. Preservation of mushrooms. Paper presented at the First National Symposium on Mushroom Science held at R.R.L. Branch, Srinagar, 22-24 September, 1976.

\*706

931 Project Title : Cultivation, storage and processing of the mushroom, Pleutorus sajor-caju.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Fruit and Vegetable Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 47,030/-  
 Duration : April 1978-March 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Zakia Bano and others.  
 Description : Yields of this mushroom in rainy, winter and summer seasons were tested and yield during rainy season was higher. Supplementation of mushroom beds with organic nitrogen sources like cottonseed powder and yeast mud increased the yield by 100%. Rice and wheat bran supplementation increased the yields by 50-60%. Organic nitrogen sources also helped in producing the second crop at an early period. Delignification of straw with sodium hydroxide or of swelling straw with phosphoric acid slightly increased the yield. Mushroom packed in 100 gauge perforated polythene bags kept well for 36 hours. Ethyl and methyl formate (300 mg litre) and exposure period of 4 hours effectively controlled *Sclerotium rolfsii* in straw beds. Moisture sorption and storage studies were also conducted on dehydrated mushroom (*P. flabellatus*). In products subjected to blanching and chemical treatment (including dipping in citric acid and sugar), the initial moisture was 6.3 and 4.5% respectively with corresponding critical moisture values of 8.5 and 10.00% respectively. In storage studies, the unblanched and blanched and sugar treated product had a storage life of 2 months and one month and 2 months each respectively at 27 C and 65% RH and 38 C and 90% RH. In foil laminates, the storage life was 3 and 2 months respectively in both blanched and sugar treated varieties.  
 Report(s) : Final.  
 Papers Published : 1. Zakia Bano and others. Cultivation of *Pleutorus sajor-caju* mushroom. Presented at the National Seminar on Research, Production, Processing and Marketing of Mushrooms, New Delhi, 1978.  
 2. Zakia Bano and others. Mineral and heavy metal content in the sporophores of *pleutorus* species. Mushroom news letter from Tropics. 2(2); 1981.

\*715

## Soft drinks and Fruit juices

- 932 Project Title : Development of soft drink formulations.  
 Organisation : Regional Research Laboratory, Canal Road, Jammu Tawi 180 001.  
 Project Category : Applied.  
 Cost : Rs. 62,500/-.  
 Duration : July 1976-December 1984.  
 Sponsor(s) : Council of Scientific and Industrial Research.  
 Investigator(s) : Bhatia, A.K. and others.  
 Description : A process for producing cheap soft drinks to replace the costly carbonated beverages and fruit juices is being developed.  
 Report(s) : -  
 Papers Published : -  
 \*716
- 933 Project Title : Flavour blends for soft drinks.  
 Organisation : Central Food Technological Research Institute, Mysore 570 013; Plantation Products and Flavour Technology Discipline.  
 Project Category : Applied and Developmental.  
 Cost : Rs. 6,30,000/-  
 Duration : April 1978-March 1981.  
 Sponsor(s) : Institute.  
 Investigator(s) : Natarajan, C.P. and others.  
 Description : Orange oil was freed of hydrocarbon by methods like solvent partition, fractional distillation and column chromatography and an acceptable carbonated orange flavoured beverage prepared from alcohol extracted and fractionally distilled oils. Similarly an acceptable lemon-lime carbonated beverage was prepared from deterpenated citrus oils. An isolate free from volatile oil obtained from styrax benzoin was found to impart cloudiness to soft drinks like orange and lime. A ready-to-mix orange flavoured beverage base in paste form was prepared which consists of flavour and other ingredients and can be packed and sealed in collapsible tubes. Deterpenated ginger oil was found to be an acceptable stable flavour ingredient in the preparation of carbonated ginger beverage. The know-how for flavour blends for orange and lime-lemon carbonated beverages has gone into commercial production. A flavour base for the preparation of carbonated coffee beverage has been developed and is ready for release to the industry.  
 Report(s) : Final.  
 Papers published : 1. Natarajan, C.P. and others. Development of flavours, colours and additives for soft drinks. Present at Symposium on problems and prospects of Food Fermentation and Beverage Industry, Bangalore, May 1981.  
 2. Shankaranarayana, M.L. and others. Flavours for soft drinks Presented at Symposium and their Industrial Applications, R.R.L., Jammu, May 1982.  
 \*773
- 934 Project Title : Utilisation of palm syrup.  
 Organisation : Department of Chemical Technology, University of Bombay, Matunga Road, Bombay 400 019.  
 Project Category : Applied.  
 Cost : Rs. 7,000 per year.  
 Duration : Two years.  
 Sponsor(s) : University Grants Commission, New Delhi.  
 Investigator(s) : V.V Mohadikar and P.R. Kulkarni.  
 Description : Conditions for clarification and concentration of neera to a palm syrup concentrate, potentially useful as a sweetening



agent in food industry are being standardised.

Report(s) : -

Papers Published : -

935 Project Title : Formulation of beverage with milk and/or egg proteins.  
 Organisation : Tamil Nadu University; Agricultural College and Research Institute, Coimbatore 641 003; Food Technology Department.  
 Project Category : Applied.  
 Cost : Rs. 25,000/-.  
 Duration : 1974-1980.  
 Sponsor(s) : University.  
 Investigator(s) : Neelakantan, S.; Shanthi, A.P.  
 \*718

#### Tea

936 Project Title : Blending of clonal tea.  
 Organisation : Tea Research Association; Tocklai Experiment Station, Jorhat-785 008  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977  
 Sponsor(s) : Tea Research Association.  
 Investigator(s) : Das, A.K.  
 Description : In view of the difficulties in mixing teas from jats and clones after manufacture brought out in earlier experiments an attempt was made to investigate the effect of mixing of jat and clonal leaves in the green leaf stage on CTC liquor. Leaves from TV1, TV9, TV 18 and Betjan jat were withered to about 75% and manufactured by CTC process. The cup qualities of Betjan were further improved when 15% withered leaf of Clone TV1 was mixed with 85% withered leaf of the jat. Similarly cup characters of the yield clones TV9 and TV 18 were improved when mixed with 80% withered leaf of the Betjan jat.  
 Report(s) : Annual report.  
 Papers Published : -

937 Project Title : Improvement of clonal CTC leaf appearance.  
 Organisation : Tea Research Association; Tocklai Experiment Station, Jorhat-785 008  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979  
 Sponsor(s) : Tea Research Association.  
 Investigator(s) : Das, A.K.  
 Description : Further observations were made on split CTC method of manufacture. It was found that teas made from clones. TV1, TV 16 and TV 17 tended to be a little blacker but with decline in brightness and briskness in the cup.

938 Project Title : Assessment of cup characters of clones and stocks.  
 Organisation : Tea Research Association; Tocklai Experiment Station, Jorhat-785 008.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Tea Research Association.  
 Investigator(s) : Sen, A.K.  
 Description : Twelve estate clones and 8 biclinal stocks of TV1 were subjected to orthodox and CTC manufacturing processes and the

resultant teas evaluated for cup characteristics. Result showed that 8 clones and 4 biclonal stocks came up well in respect of cup characteristics. Leaf samples of Tocklai released clones from areas using nitrogenous manure were also subjected to manufacture for evaluation. All the above studies are being continued. Clones were evaluated. Two estate clones and one stock were studied to see the effect of different methods employed for bringing up young tea on cup characteristics. No differences were observed in the quality of young tea during formative stages when brought up by different methods, though there were noticeable quality differences with prunings and skiffings and the kinds of jats and clones.

- Report(s) : Annual report.  
Papers Published : -
- 939 Project Title : Effect of withering on enzyme activity.  
Organisation : Tea Research Association, Tocklai Experiment Station, Jorhat 785 008.  
Project Category : Fundamental and applied.  
Cost : -  
Duration : -  
Sponsor(s) : Tea Research Association.  
Investigator(s) : Ravindranath, S.D. and others.  
Description : It was found that loss of moisture during withering affected (reduced) the enzyme activity. Which in turn resulted in CTC teas with lower TF content. The withered shoots could, however, be restored to normal enzyme activity by rehydration.  
Report(s) : Annual.  
Papers Published : -
- 940 Project Title : Chemistry of tea oxidation.  
Organisation : Tocklai Experiment Station, Jorhat 785 008, Assam.  
Project Category : Applied.  
Cost : -  
Duration : 1981-1983.  
Sponsor(s) : Tea Research Association.  
Investigator(s) : Ravindranath, S.D. and others.  
Description : The commercial applicability of the Tocklai fermentation test is being investigated. The optimal time of fermentation after withering and rolling of tea leaf is an important step in tea manufacture. The Tocklai fermentation test, the consistency in the quality of tea.  
Report(s) : 1. Commercial application of Tocklai fermentation test. Report by S.D. Ravindranath and M.N. Dev Choudhury.  
Papers Published : 1. Bajaj, K.L. Tocklai fermentation test. Tocklai Conference Proceedings, 1975.  
2. Chakraborty, S. Tocklai fermentation test, Two and a bud. 23; 1976; 50.  
3. Ullah, M.R., Bajaj, K.L., Chakraborty, S. Factory floor fermentation test. Tea Research Association Advisory Leaflet No.12, 1979.
- 941 Project Title : Green tea: Effect of rolling pressure, rolling time and different types of rolling on appearance, grade percentage on quality.  
Organisation : Tea Research Association; Tocklai Experiment Station, Jorhat-785 008.  
Project Category : Applied.  
Cost : -  
Duration : 1979-.



Sponsor(s) : Tea Research Association.  
Investigator(s) : Sen, A.K.  
Description : The four treatment tried were (a) light pressure, (b) medium pressure, (c) heavy pressure (d) cap just floating, i.e. no pressure (control). Treatment (c) during rolling after steaming accelerated the twisting action and increased the percentage of Dhulli with reduction of the quality of bold leaf and percentage of Sowmee (dust). The treatment (b) followed treatment (c) in giving the above effect. Heavy pressure treatment (c) during rolling raised the temperature of the rolling drum causing exposition of red stalk when the leaf was not properly boiled or steamed.  
Report(s) : Annual report.  
Papers Published : -

942 Project Title : Green tea. Effect of withering on appearance and cup characters of made tea.  
Organisation : Tea Research Association; Tocklai Experiment Station; Jorhat-785 008.  
Project Category : Applied.  
Cost : -  
Duration : 1979-  
Sponsor(s) : Tea Research Association.  
Investigator(s) : Sen, A.K.  
Description : The following treatments were studied in the manufacturing trials: (a) No wither (control) (b) two hours withering (c) four hours withering and (d) six hours withering. The treatment (a) gave the best result followed by (b). The treatments (c) and (d) gave slightly tinged colour and the tea was not green in appearance. The treatments (b), (c) and (d) produced hard stalk and bold yellow leaf with increased percentage of sowmea (dust) grade. The liquors in cup were deep in colour resembling black tea liquor and were not sweet in taste as in treatment (a).  
Report(s) : Annual report.  
Papers Published : -

943 Project Title : Green tea: Effect of different plucking rounds on appearance and cup characters of made tea.  
Organisation : Tea Research Association, Tocklai Experiment Station, Jorhat-785 008  
Project Category : Applied.  
Cost : -  
Duration : 1979-  
Sponsor(s) : Tea Research Association.  
Investigator(s) : Sen, A.K.  
Description : The following treatments (plucking) were tried: a) 7 days plucking and (d) 13 days plucking. Treatment (a) gave good cup quality followed by (b). Leaf from seven day round (treatment) gave somewhat less bold yellow leaf and Sowmee (dust) than that from nine day round. Longer plucking rounds gave inferior tea.  
Report(s) : Annual report.  
Papers Published : -

944 Project Title : Biochemical evaluation of tea quality as affected by agro-techniques: Effect of NPK.  
Organisation : Tea Research Association; Tocklai Experimental Station, Jorhat 785 008  
Project Category : Fundamental and applied.

- Cost : -  
Duration : -  
Sponsor(s) : Tea Research Association.  
Investigator(s) : Ravindranath, S.D. and others.  
Description : Earlier studies on P and K fertiliser at doses of 0.45 and 180 kg/ha had revealed that application of upto 45 kg/ha had a beneficial effect while K had a somewhat depressing effect on the quality of made teas. In a more systematic study with clone TV 2 (DS) the above observation was confirmed. Treatment with N without P and K had the highest TF content as also TF/TR ratio and fetched the highest price from tasters. Application of K alongwith N decreased TF and lowered TF/TR ratio thus corroborating the earlier observation on the depressing effect of K on tea quality. Application of P at the rate of 45 kg/ha along with N did not affect the quality of tea and the tasters considered it as the second best. Higher dose of P (90 kg/ha) was slightly inferior both in TF content and TF/TR ratio. Treatment with both P and K at 45 kg/ha each showed the highest amount of NPK in the shoots and the corresponding teas had the lowest TF content and considered inferior by tasters. Studies are continuing on the effect of P and K on the quality of both CTC and orthodox teas.
- Report(s) : Annual report.  
Papers Published : -
- 945 Project Title : Nitrogen metabolism in tea leaf: Effect of fertiliser nitrogen on various chemical components of tea leaf and roots and on quality of made teas.
- Organisation : Tea Research Association; Tocklai Experiment Station, Jorhat 785 008
- Project Category : Fundamental and applied.  
Cost : -  
Duration : -  
Sponsor(s) : Tea Research Association.  
Investigator(s) : Ravindranath, S.D. and others.  
Description : Preliminary studies on roots of clone TV 9 have shown that the nitrate reductase activity (NRA) varied with the dosage (100,200,300 kg/ha) of N applied as ammonium sulphate. The NRA was the highest with 200 kg N per ha and declined in the roots receiving 300 kg N per ha. Detailed studies with NRA are in progress. In studies on tea polyphenols, it was found that the six major polyphenols (Epigallocatechin, Epigallocatechin gallate, Epicatechin galate, Epicatechin, Catechin/gallic acid, theogallin) changed marginally in the shoots receiving different quantities of N. The biosynthesis of the polyphenols was maximum at 200 kg N/ha. Increase in dosage to 300 kg N/ha adversely affected the by synthesis particularly of epigallocatechin gallate. There was some difference among tea tasters in preference between teas receiving 100 and 200 kg/ha N respectively and the studies are therefore continuing to establish the effect of N on tea quality. It was also found that of the N fraction, total N, soluble N, amide N and protein N in feeder roots increased with N dosage.
- Report(s) : -  
Papers Published : -
- 946 Project Title : Industrial uses of tea leaf.  
Organisation : Tea Research Association; Tocklai Experimental Station, Jorhat 785 008, Assam.  
Project Category : Applied.



- Cost : -  
Duration : 1981-1986.  
Sponsor(s) : Tea Research Association.  
Investigator(s) : Ravindranath, S.D. and others.  
Description : The project envisages the extraction of industrially useful chemicals such as chlorogenic acids, catechin derivatives, caffeine, theaflavin, food colours, etc. from tea leaves and the utilization of these pharmacologically and also starting materials for antioxidants.
- Report(s) : -  
Papers Published : -
- 947 Project Title : Investigations on volatile constituents of teas.  
Organisation : Tea Research Association; Tocklai Experiment Station, Jorhat 785 008.  
Project Category : Fundamental and applied.  
Cost : -  
Duration : -  
Sponsor(s) : Tea Research Association.  
Investigator(s) : Ravindranath, S.D. and others.  
Description : Major tea volatiles were extracted from second flush Assam and Darjeeling teas by low temperature steam distillation under vacuum. Assam teas were found to contain larger amounts of phenylacetaldehyde and benzylalcohol. The geraniol content in plain teas were only in traces. The flavoury volatile contents, however, were found ten times higher in Darjeeling teas than in Assam teas.
- Report(s) : Annual.  
Papers Published : -
- 948 Project Title : Volatile flavour constituents of tea.  
Organisation : Tocklai Experiment Station, Jorhat 785 008, Assam.  
Project Category : Fundamental.  
Cost : -  
Duration : 1979-1989.  
Sponsor(s) : Tea Research Association.  
Investigator(s) : Ravindranath, S.D. and others.  
Description : The project aims at the extraction of volatile constituents of tea for analysis. Known chemicals are also added individually or in combinations during manufacture, to enhance the inherent characters. Attempts are also made to analyse the flavouring compounds of tea in relation to tea quality.
- Report(s) : Report in Annual Scientific report, Tea Research Association.  
Papers Published : Nil
- 949 Project Title : Blackness of made tea.  
Organisation : Tea Research Association; Tocklai Experiment Station, Jorhat 785 008  
Project Category : Fundamental and applied.  
Cost : -  
Duration : -  
Sponsor(s) : Tea Research Association.  
Investigator(s) : Ravindranath, S.D. and others.  
Description : In CTC manufacture, the shade of tea appears more brown than black. Experiments were conducted in order to retain the preferred black shade, by varying processing conditions using Clone TV1 which is prone to produce brown shade. Accelerated fermentation was not helpful. Retardation of fermentation by giving a hard wither, light roll followed by split CTC gave

a blackishshade though with cup characters similar to CTC teas.  
Experiments are being continued.

Report(s) : Annual Report.

Papers Published : -

- 950 Project Title : Other forms of tea: Hot lemon tea.  
 Organisation : Tea Research Association; Tocklai Experiment Station, Jorhat 785 008.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981-  
 Sponsor(s) : Tea Research Association.  
 Investigator(s) : Sen, A.K.  
 Description : Lemon and different types of spicy flavours of natural origin were added during the manufacturing process and the resultant tea subjected to taste panel evaluation. Results have been favourable with an additional advantage of increased cuppage by 50% or more. Further work is in progress for standardisation and commercialisation of the process.  
 Report(s) : Annual report.  
 Papers Published : -
- 951 Project Title : Instant tea project.  
 Organisation : Tea Research Association Tocklai Experimental Station, Jorhat 785 008.  
 Project Category : Applied and Exploratory.  
 Cost : Rs. 11,53,000/-.  
 Duration : November 1974-April 1982.  
 Sponsor(s) : Tea Board, India.  
 Investigator(s) : Gogoi, M.N. and others.  
 \*723
- 952 Project Title : Production of instant tea.  
 Organisation : Tocklai Experimental Station, Jorhat 785 008, Assam.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1978-1984.  
 Sponsor(s) : Tea Research Association and Tea Board, Calcutta.  
 Investigator(s) : Ravindranath, S.D. and others.  
 Description : Standardisation of the method of manufacture of instant tea of acceptable quality and reduction of the cost of production are being attempted.  
 Report(s) : Tocklai Research Association, Annual Report, 1979-1980.  
 Papers Published : 1. Gogai, M.N. Value added tea: Bulk production of instant tea, Presented at the Tocklai Conference, Dec.1981.
- 953 Project Title : Development of flavoured teas.  
 Organisation : Central Food Technological Research Institute, Mysore.  
 Project category : Applied.  
 Cost : Rs. 56,500/-.  
 Duration : October 1980-December 1982.  
 Sponsor(s) : Institue.  
 Investigator(s) : Seshadri, R. and others.  
 Description : Flavour blends for lemon, ginger, bergamot, mint and cardamom flavoured teas were developed and evaluated for their acceptability by organoleptic evaluation. Acceptable blends were incorporated into orthodox fannings grade black teas at different concentrations level. The chemical parameters of the flavoured teas produced were studied during storage in unlacquered, sealed tin cans at 37 C and were evaluated organoleptically.



Report(s) : -  
 Papers published : -

954 Project Title : Cleaning of made tea.  
 Organisation : Tea Research Association; Tocklai Experiment Station, Jorhat-785 008.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Tea Research Association.  
 Investigator(s) : Baruah, T.C.  
 Description : A few prototype models was developed for separation of stalks from orthodox teas. Results of some trials, on one model conducted on this machine indicate that although some amount of stalks are separated from the coarse mal, the grades are not free from stalks. The trials are continuing on other models.

## Coffee

955 Project Title : Vacuum drying of coffee extracts for the production of instant coffee products.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Plantation Products and Flavour Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,75,000/-.  
 Duration : April 1978-June 1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Natarajan, C.P. and others.  
 Description : Coffee extract with 30% solids was obtained by percolation in jacketed columns with hot water (75-80 C) circulating in the jacket. Repeated percolation yielded over 90% of the coffee solubles in roast coffee powder in concentrate form. A mixture of coffee extract, milk powder and sufficient sugar to bring the solids content to 65% could be satisfactory vacuum shelf dried provided 55-60% of the sugar was replaced by malto-dextrin. Replacement of milk powder with fresh skim milk concentrated under reduced pressure to a solids content of about 45% improved organoleptic quality.  
 Report(s) : Final.  
 Papers Published : -  
 \*725

## Cocoa

956 Project Title : Formulation of Agmark grade specification of cocoa beans and cocoa powder.  
 Organisation : Central Agmark Laboratory, Nagpur 440 010.  
 Project Category : Applied.  
 Cost : Rs. 700/-.  
 Duration : 1981-1983.  
 Sponsor(s) : Directorate of Marketing and Inspection.  
 Investigator(s) : Gupta, R.D.; Paul, T.K.  
 Description : Cocoa beans and powder are analysed to prepare Agmark grade specifications in order that their exports are promoted.  
 Report(s) : -  
 Papers Published : -

957 Project Title : Upgrading of cocoa beans.  
 Organisation : Cadbury India Limited, Cadbury House, Bhulabhai Desai Road, Bombay 400 026.

Project Category : Applied.  
 Cost : Rs. 1,00,000/-.  
 Duration : June 1977-December 1979.  
 Sponsor(s) : Company.  
 Investigator(s) : Shenoy, R.D. and others.  
 \*726

958 Project Title : Improving the quality of Indian cocoa beans.  
 Organisation : Cadbury India Limited, Cadbury House, B. Desai Road, Bombay 400 026.  
 Project Category : Applied.  
 Cost : Rs. 75,000/-  
 Duration : Jan 1980-June 1982  
 Sponsor(s) : Company.  
 Investigator(s) : Shenoy, R.D. and others.  
 Description : The project is concerned with modifications of processing conditions of cocoa beans to upgrade their quality to be in line with that of beans from West Africa. The experimental work has been completed and field trials are in progress.  
 Report(s) : -  
 Papers Published : -

959 Project Title : Quality improvement in Indian cocoa beans and cocoa products.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Plantation Products and Flavour Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 2,90,000/-.  
 : March 1980-February 1982  
 Sponsor(s) : Institute.  
 Investigator(s) : Lewis, Y.S. and others.  
 Description : The size and shape of dry cocoa beans were factors for deciding correct roasting level and fat losses from diffusion into the husk increased roasting duration. Optimum time and temperature of roasting were determined for A,B and C grades (identified on the basis of length, width and shape. The optimal temperature was determined based on the evaluation of aroma of roasted beans. Certain simple treatments reduced the acidity of commercial cocoa beans and made them acceptable in the preparation of chocolate/confectionery products. It was found that cocoa butter could be extracted in modified hydraulic press after conditioning the cocoa mass. A prototype of the press was fabricated. The cake obtained from the press after extraction of cocoa butter was found to required size for use as cocoa powder. The moisture in cocoa mass for continuous extraction of cocoa butter using the press was optimised. The quality of cocoa butter and powder was improved by alkalisation or neutralisation of acidic beans. The process was released to commercial use and the production was demonstrated in trials at producing areas.  
 Report(s) : Consolidated report.  
 Papers published : -

960 Project Title : Primary processing and related technological aspects of cocoa.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Plantation Products and Flavour Technology Discipline.  
 Project Category : Fundamental.  
 Cost : Rs. 18.56 lakhs.  
 Duration : July 1982-June 1986  
 Sponsor(s) : Institute.  
 Investigator(s) : Nambudiri, E.S. and others.



- Description : The project aims to process Indian cocoa bean for adoption at village level; process demonstration and training; technological and equipment/ improvement for semi-finished products; and quality aspects of exportable surplus of raw material and semi-finished products.
- Report(s) : -
- Papers Published : -
- 961 Project Title : Processing of cocoa.
- Organisation : Central Food Technological Research Institute, Mysore 570013; Plantation Products and Flavour Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 2,80,700/-.
- Duration : October 1976-December 1979
- Sponsor(s) : Institute.
- Investigator(s) : Natarajan, C.P. and others.
- Description : Environmental modification of fermenting room and strict control over maturity and post-harvest handling of fruits (to avoid high acidity) could produce good quality beans. Electrically operated small or large scale driers were more economical than firewood heated driers. Suitable staggering in drying operations could help further reduction in drying time and improvement in quality. Chemical analysis of samples from different growing areas did not show any significant variations. A process for the manufacture of refined cocoa mass, based on indigenous equipment, was standardised and released to industry through NRDC. This product has good potential in confectionery, bakery products etc as a flavouring and colouring ingredient. Work was also done to develop product like drinking chocolate, malted beverages and ready mix formulations for household use. The sweet liquor normally wasted during fermentation could also be collected and used for jelly preparations.
- Report(s) : Final.
- Papers Published : 1. Shivashankar, S. and others. Processing of cocoa. Presented at First Indian Convention of Food Scientist and Technologist, June 1978.
2. Shivashankar, S. and others. Determination of theobromine in cocoa products. J. Food Sci. Technol. 15(4); 1978; 153
3. Lewis, Y.S. and others. Quality control aspects of cocoa products. Indian Food Packer. 1980; 29
- \*727
- 962 Project Title : Small scale processing of cocoa.
- Organisation : Kerala Agricultural University, College of Horticulture, Vellanikkara, Trichur 680 654
- Project Category : Applied.
- Cost : Rs. 10,000/-.
- Duration : 1980-1982.
- Sponsor(s) : University.
- Investigator(s) : Damodaran, V.K. and others.
- Description : Methods suitable for small scale extraction of cocoa butter and cocoa powder from cocoa beans and standardization of the process in terms of pressure and temperature of roast for extracting for butter are being developed.
- Report(s) : -
- Papers Published : -

## Fruit Juice

- 963 Project Title : Carbonated beverage.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979-1981.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Kapur, K.L.; Verma, R.A.  
 Description : Efforts are being made to produce carbonated fruit juices of long shelf life. Recipes for ginger drink, ginger squash and ginger syrup were prepared and carbonated. Squash was considered better for carbonation. Work is in progress on the carbonation of low concentrates.  
 Report(s) : -  
 Papers Published : -
- 964 Project Title : Foam mat drying of foodstuffs.  
 Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani 431 402, Department of Food Science and Technology.  
 Project Category : Applied.  
 Cost : Rs. 50,000/-.  
 Duration : June 1980-1983.  
 Sponsor(s) : University and Government of Maharashtra.  
 Investigator(s) : Gunjal, B.B.  
 Description : The objectives of the project are: (a) standardise the method in respect of foam density, foam expansion and foam stability for vegetable and fruit juices (b) study the drying characteristics of the products (c) packaging and storage studies on the dried product and (d) study of the economy of the process. The first objective has been achieved and preliminary experiments have been conducted on foam mat drying of guava and mango pulp. Extensive studies on several heat sensitive products are in progress.  
 Report(s) : Annual.  
 Papers Published : -
- 965 Project Title : Rheological properties of fruit juices.  
 Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani 431 402; Department of Food Science and Technology.  
 Project Category : Applied.  
 Cost : Rs. 80,000/-.  
 Duration : July 1979-1982.  
 Sponsor(s) : University and Government of Maharashtra.  
 Investigator(s) : Gunjal, B.B.  
 Description : The objectives of the project is to (a) determine the rheological constants for various food liquids and pulps; and (b) study the effect of concentration and temperature on rheological parameters. So far studies have been carried out on apple juice, orange juice and mango pulp and rheological constants determined. Work is in progress to determine the effect of temperature and concentration on rheology of the products.  
 Report(s) : Annual.  
 Papers Published : -



- 966 Project Title : Some studies on bulk storage of fruit juices and pulps with special reference to mango and tomato.  
 Organisation : Central Food Technological Research Institute, Mysore-570013; Fruit and Vegetable Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 86,000/-.  
 Duration : April 1977- March 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Nanjundaswamy, A.M. and others.  
 Description : Three and four poly aluminium laminate pouches, Mylar pouches and Jerry cans made of food grade high density polyethene (HDPE) were tested for packing mango pulp. The product was packed by standard procedure in the containers, stored at 37 C and analysed periodically. No sign of fermentation in any pack was noticed. There was slight discolouration and development of off-flavour in Mylar pouch packed samples. Tomato paste was prepared by using a forced circulation evaporator and preserved in food grade HDPE jerry cans using several chemicals. During vacuum concentration no loss of ascorbic acid was noticed. Of the chemicals used, sodium chloride and acetic acid in combination were most effective in preserving tomato paste in Jerry cans. Based on these findings a simple method was standardised using 5 kg Jerry cans. Studies were also extended to 25 kg Jerry cans.  
 Report(s) : Final.  
 Papers Published : -  
 \*730
- 967 Project Title : Studies on deacidification of fruit juices by electrodialysis.  
 Organisation : Central Food Technological Research Institute, Mysore 570020; Fruit and Vegetable Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 50,000/-.  
 Duration : June 1982-June 1984.  
 Sponsor(s) : Institute.  
 Investigator(s) : Nanjundaswamy, A.M.; Chikkappaji, K.C.  
 Description : A suitable method to acidify juices of fruits like pineapple, orange and Bangalore grapes is developed. Of the several methods experimented, deacidification by electrodialysis (ED) appears to be more practicable and commercially viable.  
 Report(s) : -  
 Papers Published : -
- 968 Project Title : Further studies on bulk storage of fruit juice and pulps and testing the suitability of HDPE containers for fruit products.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Fruit and Vegetable Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 96,500/-.  
 Duration : June 1982-June 1984.  
 Sponsor(s) : Institute.  
 Investigator(s) : Nanjundaswamy, A.M. and others.  
 Description : Conditions were standardised for thermal bulk preservation of mango pulp in 55 kg capacity HDPE rigid containers. In order to test the validity of the process under the factory condition mango pulp was extracted and packed according to the standardised procedure and stored at different storage temperatures. Containers were withdrawn at periodic intervals and the pulp samples were examined for their microbial sterility, chemical changes and organoleptic qualities. For testing the suitability of HDPE

containers for packing fruit and vegetable products, test samples like orangesquash, pineapple jam, tomato ketchup, mango chutney were packed in suitable food grade HDPE containers stored at different storage temperature and their shelf life determined as compared with the samples packed in conventional containers. HDPE bottles were found to be unsuitable for packing orange squash as there was off flavour development and considerable loss of SO<sub>2</sub>.

Report(s) : -  
Papers Published : -

969 Project Title : Canning of mango juice.  
Organisation : Rajendra Agricultural University; Bihar Agricultural College, Sabour, Bihar; Fruit Preservation Laboratory.  
Project Category : Applied.  
Cost : -  
Duration : May 1976-May 1979.  
Sponsor(s) : University.  
Investigator(s) : Singh, R.K. and others.  
\*731

970 Project Title : Processing of apple into natural and clarified juice and its concentration.  
Organisation : Regional Research Laboratory, Canal Road, Jammu Tawi 180 001.  
Project Category : Applied.  
Cost : Rs. 62,500/-.  
Duration : July 1976-December 1984.  
Sponsor(s) : Council of Scientific and Industrial Research.  
Investigator(s) : Bhatia, A.K. and others.  
Description : The project studies the utilization and processing of the apple fruits. Standardization techniques have been developed for the preservation of apple juice in natural form as well as clarified fruit juice. Techniques for the concentration of natural apple juice are also being developed.  
Report(s) : -  
Papers Published : 1. Dang, R.L. and others. Studies on Kashmir apples. I. Chemical characteristics. Indian Food Pack. 28(6); 1974; 5-9  
2. Dang, R.L. and others. Studies on Kashmir apples. II. Canning as rings. Indian Food Pack. 30(4); 1976; 9-14.  
\*732

971 Project Title : Upgrading tart apple juice by de-acidification technology.  
Organisation : Regional Research Laboratory, Canal Road, Jammu Tawi 180001.  
Project Category : Applied.  
Cost : Rs. 62,500/-.  
Duration : July 1976-December 1984.  
Sponsor(s) : Council of Scientific and Industrial Research.  
Investigator(s) : Bhatia, A.K. and others.  
Description : Better utilization of tart apple crop in Kashmir for industrial exploitation through deacidification of juice has been attempted. The process is to be scaled up to pilot plant level.  
Report(s) : -  
Papers Published : 1. Bhatia, A.K. and others. Deacidification of apple juice by ion exchange resins. Indian Food Pack. 33(1); 1979; 1-6.  
2. Dang, R.L. and others. Studies on Kashmir apples. IV. Varietal blends for the manufacture of apple juice. Indian Food Pack. 33(2); 1979; 1-4  
\*733



- 972 Project Title : Utilization of cashew apple for the preparation of unfermented beverages.  
 Organisation : Kerala Agricultural University; College of Horticulture, Vellanikkara, Trichur 680 654.  
 Project Category : Applied.  
 Cost : Rs. 10,000/-.  
 Duration : 1981-1982.  
 Sponsor(s) : University.  
 Investigator(s) : Damodaran, V.K. and others.  
 Description : The utilization of cashew apples for preparing various unfermented beverages, the assessment of the quality and storage life of the products; and the utilization of cashew apple waste as cattle feed are being investigated.  
 Report(s) : -  
 Papers Published : -
- 973 Project Title : Grape juice.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : April 1980 -December 1981.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Revis, B.; Shukla, K.G.  
 Description : Nine varieties of grapes, namely, Pusa seedless, Cordial, Kismis red, Khalili, Motia, Beauty, seedless, Perlette, Himrod and Gulabi, have been studied for finding out their suitability for juice making.  
 Report(s) : -  
 Papers Published : -
- 974 Project Title : Carrot beverage (non-alcoholic)  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : March 1980 - March 1982.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Revis, B; Shukla, K.G.  
 Description : A carrot beverage by blending carrot juice with various fruit juices, citric acid, ascorbic acid and artificial flavour is being standardised. Several combinations are now under storage studies.  
 Report(s) : -  
 Papers Published : -
- 975 Project Title : Phalsa beverage (non-alcoholic).  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : April 1978 - December 1981  
 Sponsor(s) : Government of Uttar Pradesh  
 Investigator(s) : Revis, B. and others.  
 Description : Juice was extracted by cold extraction, hot extraction and pectic enzymes. The ready-to-serve beverages prepared from the juice (drink, syrup and squash) were subjected to different treatments before storage so as to retain phalsa colour. Results have been successful.  
 Report(s) : -  
 Papers Published : -

- 976 Project Title : Browning of processed products.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost :  
 Duration : 1979-1980 - 1982-1983  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Surjeet Singh; Tripathi, V.K.  
 Description : Squashes will be prepared by conventional methods from fresh litchi fruits and after subjecting the juice to treatments such as freezing, thawing and incubating at high temperatures. Storage studies at room temperature will be conducted in bottles for untreated squash as such and for untreated squash after treating it with different concentrations of chemicals like cystein, EDTA etc. Samples will be analysed at regular intervals for colour, biochemical changes and organoleptic quality. The purpose is to identify the factors responsible for browning in squashes of different varieties of litchi and to find out ways and means to control the incidence of discolouration.  
 Report(s) :  
 Papers Published : -
- 977 Project Title : Development of carbonated beverage out of tamarind.  
 Organisation : Food Crafts Institute, Shivajinagar, Pune 411 005.  
 Project Category : Applied.  
 Cost : Rs. 500/-.  
 Duration : 1982-1983  
 Sponsor(s) : Institute.  
 Investigator(s) : Gangolli, V.A. and others.  
 Description : Development of carbonated beverage out of tamarind has been attempted and its acceptability is being tested.  
 Report(s) : -  
 Papers Published : -
- 978 Project Title : Preservation of unconventional juices.  
 Organisation : Food Crafts Institute, Shivajinagar, Pune 411 005.  
 Project Category : Applied.  
 Cost : Rs. 2,000/-.  
 Duration : 1979-1982.  
 Sponsor(s) : Institute.  
 Investigator(s) : Gangolli, V.A. and others.  
 Description : The project has been concerned with preparing juices from Karvanda, Kokum, tamarind, etc.  
 Report(s) : -  
 Papers Published : -

### Alcoholic beverage

- 979 Project Title : Production of Alcohol from sugarcane.  
 Organisation : National Sugar Institute.  
 Project Category : Applied.  
 Cost : Rs. 15.50 lakhs.  
 Duration : 1980-1983.  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Ramaiah, N.A. and others.  
 Description : The project envisages production of alcohol from conversion of sugarcane juice directly into ethanol.  
 Report(s) : -  
 Papers Published : -



- 980 Project Title : Alcohol production in tubular reactors.  
 Organisation : Nagpur University; Laxminarayan Institute of Technology; Nagpur, Food Technology Section.  
 Project Category : Exploratory.  
 Cost : -  
 Duration : 1978 onwards.  
 Sponsor(s) : University.  
 Investigator(s) : Rao, B.Y. and others.  
 Description : Alcohol producing yeast is bound on sterile solid media and packed in glass columns. Sugar solution is passed through the column to produce alcohol. Various parameters like density of packing, column dimensions, temperatures, flow rates, etc. are studied for obtaining maximum amount of alcohol.  
 Report(s) : -  
 Papers Published : -
- 981 Project Title : Treatment of distillery effluents.  
 Organisation : National Sugar Institute, Kanpur, Uttar Pradesh.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977-1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Vishwanathan, L.; Prabhu, K.A.  
 \*737
- 982 Project Title : Improvements in fermentation processes for economic production of ethanol.  
 Organisation : Central Food Technological Research Institute, Mysore 570 013; Microbiology and Fermentation Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 4,28,500/-.  
 Duration : September 1982-August 1985.  
 Sponsor(s) : Institute, Mysore 570 013;  
 Investigator(s) : Basappa, S.C. and others.  
 Description : A continuous IL fermentor has been developed for molasses fermentation using immobilized yeast and found to yield alcohol conversion efficiency of more than 98% of the theoretical yield. The activity of immobilized yeast was as good as free cells of yeast. The conversion efficiency of immobilization of yeast in calcium alginate was found to be better than that in agar agar. Process conditions for the production of a Marmite like yeast hydrolysate have been standardized. Trehalose content of bakers yeast have been worked out in 10 l fermentor.
- 983 Project Title : Studies on maturation of distilled liquor.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Microbiology and Fermentation Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 2,98,000/-.  
 Duration : June 1977-May 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Subba Rao, M.S. and others.  
 Description : Maturation of brandy in wooden vats made from various Indian woods was studied to evaluate their suitability. Some phenolics separated from alcoholic extract of these woods (Indian oak, teak, red cedar and sandalwood) by precipitation with formaldehyde, adsorption with silica gel, solubilisation with trichloroacetic acid and extraction with different solvents showed promise in reducing harshness when added to brandy.

Report(s) : Final.  
 Papers Published : 1. Venkataramu, K. and others. Fractionation of wood phenolics and their use in brandy. J. Food Sci. Technol. 20; 1983; 16.  
 2. Venkataramu, K. and others. Studies on extraction of phenolics of wood by brandy. Indian Food Packer. 34(4); 1980; 22

\*736

- 984 Project Title : Manufacture of fining agent from fish maws.  
 Organisation : University of Agricultural Sciences; College of Fisheries, Mangalore 575 001; Department of Fish Processing Technology.  
 Project Category : Applied  
 Cost : Rs. 1,500  
 Duration : September 1981-August 1982.  
 Sponsor(s) : UAS, Bangalore.  
 Investigator(s) : Haridas Bhandary, M.  
 Description : The project intends to develop know-how for the manufacture of fining agent from fish maws for clarification of beer, as such as know how is not available in India at present.  
 Report(s) : -  
 Papers Published : -
- 985 Project Title : Kaphal beverage (alcoholic and non-alcoholic).  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : April 1981-December 1983.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Revis, B. and others.  
 Description : Efforts are being made to utilise kaphal for the preparation of fermented and non-fermented beverages. Ready-to-serve drinks, squash and wine have already been prepared and these will be studied for chemical composition and shelf life.  
 Report(s) : -  
 Papers Published : -
- 986 Project Title : Preparation of cider.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : Rs. 2,000/-.  
 Duration : August 1981- March 1982.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Revis, B. and others.  
 Description : Earlier, cider making qualities of some varieties of apple grown in Kumaon region were studied. Currently, work is in progress on the progress of cider of high quality by blending juices of different varieties of apples having different acid and tannin contents, and using natural fermentation and pectic enzymes.  
 Report(s) : -  
 Papers Published : 1. Revis, B. and Shukla, K.G. Studies on cider making qualities of some varieties of apple grown in Kumaon region. Progressive Horticulture. 8(2); 1976; 49-58
- 987 Project Title : Fruit wines.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B, Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : March 1981- December 1984



- Sponsor(s) : Government of Uttar Pradesh.  
Investigator(s) : Revis, B. and others.  
Description : Enological qualities of different varieties of mango, guava, jamun, gooseberry and pear grown in Uttar Pradesh are being evaluated. Currently work is in progress with mango and jamun to be followed by other fruits.  
Report(s) : -  
Papers Published : -
- 988 Project Title : Evaluation of indigenous and exotic grape varieties and new hybrids for wine making.  
Organisation : Indian Institute of Horticultural Research, 255, Upper Palace Orchards, Bangalore 560 080.  
Project Category : Applied.  
Cost : -  
Duration : August 1970 - Continuing.  
Sponsor(s) : ICAR  
Investigator(s) : Ethiraj, S.; Suresh, E.R.  
Description : -  
Report(s) : -  
Papers Published : 1. Ethiraj, S. and Suresh, E.R. Deacidification of high acid grape musts and wine making with Schizosaccharomyces pombe. J. Food Sci. Technol. 15(3); 1978; 111-113  
2. Ethiraj, S. and Suresh, E.R. Effect of heating grape musts on pH and acidity of musts and colour and tannin content of red wines. J. Food Sci. Technol. 15(5); 1978; 195-97.  
3. Ethiraj, S. and others. Nature of yeasts present on grapes grown in South India and in their wines. Vitis 18; 1979; 161-64  
4. Negi, S S. and Suresh, E.R. Properties of musts of some grape varieties. Indian J. Hort. 29(1); 1972; 48-50.  
5. Suresh, E.R. and Negi, S.S. Evaluation of some grape varieties for wine quality. J. Food Sci. Technol. 12(2); 1975; 79-81.  
6. Selvaraj, Y. and others. Sugars, organic acids, amino acids and invertase activity of juices from 22 grape varieties. J. Food Sci. Technol. 12(2); 1975; 75-8.  
7. Suresh, E.R. and others. A note on the effect of freezing grape bunches on the composition of musts and wines. J. Food Sci. Technol. 18; 1981; 119-120.

### Spices

- 989 Project Title : Study of the quality of spices and development of improved spice extracts.  
Organisation : Regional Research Laboratory, Trivandrum 695 019.  
Project Category : Applied.  
Cost : Rs. 4 lakhs.  
Duration : 1979-1983.  
Sponsor(s) : Council of Scientific and Industrial Research.  
Investigator(s) : Narayanan, C.S. and others.  
Description : The development of a processing technology for extracting oleo-resins and essence with fresh flavour from fresh spices; and the preparation of essences from leafy spices are being attempted. The chemical changes involved during the blackening of green

pepper are also being studied. Formulations of ready mixes of spices, oleoresin blends, dispersions and diluted spice extracts are being developed.

Report(s)

Papers Published

1. M.A. Sumathikutty, K. Rajaraman, B. Sankarikutty and A.G. Mathew. Chemical composition of pepper grades and products. *Journal of Food Science and Technology*, 1979, 16(6)
2. A.G. Mathew, K. Rajaraman, A.V. Bhat, V.P. Sreedharan, M.A. Sumathikutty, B. Sankarikutty, C.S. Narayanan. Studies on prevention of fungus in black pepper. *Indian Food Packer*.
3. C.S. Narayanan, M.A. Sumathikutty, B. Sankarikutty, K. Rajaraman, A.V. Bhat and A.G. Mathew. Studies on separation of high pungent oleoresin from India chilli. *J. Food Sci. Technol.* 17(3), 1980, 136
4. M.A. Sumathikutty, K. Rajaraman, B. Sankarikutty, C.S. Narayanan and A.G. Mathew. Piperine. *J. Food Sci. Technol.*

990 Project Title

Organisation

Project Category

Cost

Duration

Sponsor(s)

Investigator(s)

Description

: Evaluation of quality of spices and their oleoresins.  
 : Central Food Technological Research Institute, Mysore 570013; Sensory Evaluation Discipline.  
 : Fundamental and Applied.  
 : Rs. 1,06,850/-.  
 : January 1973 - March 1979.  
 : Institute.  
 : Govindarajan, V.S. and others.  
 : TLC-aromagram studies were conducted with turmeric and cardamom to enumerate the various descriptors in order of intensity which are in turn used to draw up the aroma profile by a panel. With turmeric essential oil, from fresh and dry samples studies showed the presence of turmerones (with typical dry turmeric aroma) along with 4-6 oxygenated compounds and terpenic hydrocarbons. No correlation between sensory aroma intensity and levels of these constituents was noticed, though one oxygenated compound (low Rf) having significantly green turmeric aroma was present in small quantities. Methods including TLC were developed to detect admixtures (5% levels) of *C. longa* and *C. aromatica*. No correlation existed between sensory colour and curcumin content in these varieties. With cardamom, differences existed between Ceylon and Coorg varieties and the former was rated superior. Several components other than terpenyl and linolyl acetates and cineole were detected by GC and efforts were made to evaluate their significance. Reliability of 3.42 nm absorption as a measure of pungency stimulus was evaluated in pepper and chillies. Paper chromatography was successfully applied to determine capsaicin in green chillies.

Report(s)

Papers Published

- : Final
1. Ananthakrishna, S.M. and Govindarajan, V.S. Evaluation of spices and oleoresins. IV. Estimation of pungent principles of ginger oleoresin. *Lebensm-Wiss Technol.* 7, 1974, 220.
  2. Ananthakrishna, S.M. and Govindarajan, V.S. Evaluation of spices and oleoresins. V. Estimation of pungent principles of pepper. *J. Food Sci. Technol.* 12, 1975, 253
  3. Bhagya. Detection of capsaicin in adulterated ginger oleoresin. *J. Food Sci. Technol.* 14(4), 1977, 176
  4. Bhagya and others. Evaluation of spices and oleoresins. VIII. Improved separation and estimation of pungent and related compounds of ginger by TLC. *J. Food Qual.* 2, 1979, 95
  5. Govindarajan, V.S. and others. Evaluation of spices and oleoresins. II. Pungency of capsicum by Scoville heat units a standardised procedure. *J. Food Sci. Technol.* 14(1), 1977, 28.



6. Govindarajan, V.S. Evaluation of spices and oleoresins. J. Plantation Crops. 1. (Suppl.); 1973; 195
7. Govindarajan, V.S. and others. Evaluation of horticultural varieties and trade types of pepper. J. Plantation Crops. 1(1&2); 1973; 8
8. Govindarajan, V.S. Pepper: Chemistry, technology and quality evaluation. Crit. Rev. Food Sci. Nutr. 14; 1977; 176'
9. Raghavveer, K.G. and Govindarajan, V.S. Evaluation of spices and oleoresins. VII. Gas chromatographic examination of gingerol, shogol and related compounds in ginger. J. Food Qual. 2; 1979; 41

- 991 Project Title : Evaluation of quality of spices and their oleoresins with special reference to turmeric, cardamom and other minor spices.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Sensory Evaluation Discipline.  
 Project Category : Applied  
 Cost : Rs. 1,67,500/-.  
 Duration : April 1979-March 1981  
 Sponsor(s) : Institute.  
 Investigator(s) : Raghuvveer, K.R. and others.  
 Description : Various methods evaluating spices and their oleoresins have been developed. They are based on TLC, GLC and paper chromatography. Each method has been extensively studied with different spices for evaluating their reliability and reproducibility.  
 Report(s) : -  
 Papers Published : -
- 992 Project Title : Spice beneficiation and production of spice products.  
 Organisation : CSIR Trivandrum Complex, Industrial Estate, Trivandrum 695 019  
 Project Category : Applied.  
 Cost : -  
 Duration : 1976-1979.  
 Sponsor(s) : Council of Scientific and Industrial Research, New Delhi.  
 Investigator(s) : Mathew, A.G. and others.  
 \*738
- 993 Project Title : Metabolic and biochemical aspects of spices.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Biochemistry and Applied Nutrition Discipline.  
 Project Category : Fundamental and Applied.  
 Cost : Rs. 2,50,000/-.  
 Duration : January 1975-March 1979.  
 Sponsor(s) : CSIR  
 Investigator(s) : Satyanarayana, M.N. and others.  
 Description : The studies concerned the metabolic effects of major spices (chillies, ginger, pepper and coriander) and their main active principles in terms of general influence on growth and intermediary metabolism of proteins, carbohydrates and lipids; their influence on digestive and hormonal secretions, and their effects on sensory tissues of the taste and olfactory system, gastro intestinal tract and various organs. Efforts were also made to understand the metabolic and biochemical action of spices and spice constituents to enable diversify their applications  
 Report(s) : Final  
 Papers Published : 1. Sambiah, K. and others. Biochemical and metabolic aspects of spices. Presented at Annual Meeting of Society of Biological Chemists (India), Madras, September 1977.  
 2. Sambiah, K. and others. Biochemistry and metabolism of spices with special reference to turmeric (*Curcuma longa*) and red

- chillies (*capsicum* sp.). Proc. Symposium of Federation of Asian and Oceanic Biochemists (FAOB), The Malaysian Biochemical Society, 1980; 50.
1. Sambiah, K. and others. Biochemistry of food additives: A review of work on spices with special reference to turmeric and red pepper. Presented at Annual Meeting of Biological chemists (India), Lucknow, October 1979.
  2. Sambiah, K. and others. Biochemistry of spices. Presented at the Symposium Federation of Asian and Oceanic Biochemists (FAOB), Nagoya, Japan, October 1977).
  3. Sambiah, K. and others. Effect of red pepper (chillies) and capsaicin on fat absorption and liver fat in rats. *Nutr. Rep. Int.* 18(5); 1978; 521.
  4. Sambiah, K. and Satyanarayana, M.N. Hypocholesterolemic effect of red pepper and capsaicin. *Indian J. Exp. Biol.* 18; 1980; 898.
  5. Sambiah, A. and Satyanarayana, M.N. Influence of capsaicin on lipid metabolism in rats. Presented at Annual Meeting of Society of Biological Chemists, India, Bangalore, December 1980.
  6. Sambiah, K. and Satyanarayana, M.N. Lipotrope-like activity of red pepper. *J. Food Sci. Technol.* 19(1); 1982; 30
  7. Srinivasan, M.R. and others. Absorption and tissue distribution of capsaicin. Presented at Annual Meeting of Society of Biological Chemists (India), Baroda, November 1981.
  8. Srinivasan, M.R. and others. Effect of long term feeding of chillies or capsaicin in experimental rats. Presented at Annual Meeting of Society of Biological Chemists (India), Hyderabad, November 1976.
  9. Srinivasan, M.R. and others. Influence of red pepper and capsaicin on growth, blood constituents and nitrogen balance in rats. *Nutr. Rep. Int.* 21; 1980; 455.
  10. Srinivasan, M.R. and others. Studies on spices. Presented at Annual Meeting of Society of Biological Chemists (India), New Delhi, October 1978.
  11. Srinivasan, M.R. and others. Thin layer chromatographic method for the estimation of capsaicin and related compounds. *Res. Indus.* 26; 1981; 180.
  12. Srinivasan, M.R. and Satyanarayana, M.N. Effect of black pepper (*Piper nigrum*, L.) and piperine on growth, blood constituents and organ weight in rats. *Nutr. Rep. Int.* 23; 1981; 871.
  13. Srinivasan, M.R. and Satyanarayana, M.N. Influence of pepper and piperine on growth and liver lipids of rats. Presented at International Workshop on Pepper Processing and Pepper Products, Mysore, May 1981.
  14. Vijayalakshmi Ravindranath and Chandrasekhara, N. Absorption and tissue distribution of curcumin in rats. *Toxicology.* 16; 1980; 259.
  15. Vijayalakshmi Ravindranath and Chandrasekhara, N. In vitro studies on the absorption of curcumin in rats. *Toxicology.* 20; 1981; 251
  16. Vijayalakshmi Ravindranath and Chandrasekhara, N. Metabolism of curcumin in rats. Presented at Annual Meeting of Society of Biochemists (India), Bangalore, December 1980.
  17. Vijayalakshmi Ravindranath and Satyanarayana, M.N. A new diaryl heptanoid from curcumin in rats. *Phytochemistry.* 19; 1980; 2031.



- 994 Project Title : Processing aspects of raw spices.  
 Organisation : Regional Research Laboratory, Trivandrum - 19.  
 Project Category : Applied.  
 Cost : Rs. 8 lakhs.  
 Duration : 1979-1983.  
 Sponsor(s) : Council of Scientific and Industrial Research.  
 Investigator(s) : Bhat, A.V. and others.  
 Description : The project intends to develop suitable techniques for processing tree spices like nutmeg, clove and cinnamon; to improve drying and curing of ginger, turmeric and other spices; to develop efficient procedure for grinding of spices of export quality; to earn more foreign exchange by processing spices; and to achieve economy by using under utilized and unused wastes of spice industry.  
 Report(s) : -  
 Papers Published : 1. Gopalakrishnan, M. Chemical aspects of clarification of cinnamon leaf oil. Indian Perfumer. 23(2), 1979  
 2. Gopalakrishnan, M. and others. Identification of Mace Colour. J. Food Sci. and Technol. 16(6), 1979.  
 3. Gopalakrishnan, M. and George Varkey, A. Cinnamon barks from Manipur region of India. Indian Cocoa, Arecanut and Spices. J. 3(3), 1980, 65.  
 4. George Verkey, A. and others. Commercial Bleaching of cardamom. Cardamom J. 12(4), 1980, 9.
- 995 Project Title : Flavour profile and quality of processed spices during storage under different unit packages.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Sensory Evaluation Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 4,19,200/-.  
 Duration : August 1982-July 1985  
 Sponsor(s) : Institute.  
 Investigator(s) : Shanti Narasimhan and others.  
 Description : Spice powder are commonly marketed in low density polyethylene unit packages. The study of physico chemical and sensory quality changes that occur during storage in these. Packages was initiated with special reference to pepper powder. Polyethylene films had an inherent wide variation in thickness, hence selected areas of the film with minimum gauge variations were used to make the pouches. Three thickness of 90-100 gauge, 350-400 gauge and 450-500 gauge were selected to facilitate interpolation of the results to other gauges. Test samples were stored at 37 C with 65% RH in wooden cupboard. Data on odour profile of the powder, quality at use level, pungency evaluation, volatile oil and piperine content, moisture pick up and GC finger-printing of the oleoresin for aroma impact components have been generated for the initial withdrawals.  
 Report(s) : -  
 Papers Published : -

- 996 Project Title : Microbiological studies on whole and ground spices.  
 Organisation : Central Agmark Laboratory, Nagpur 440 010.  
 Project Category : Applied.  
 Cost : Rs. 10,500/-.  
 Duration : 1981 onwards.  
 Sponsor(s) : Directorate of Marketing and Inspection.  
 Investigator(s) : Adinarayanaiah, C.L.; Sharma, N.V.  
 Description : The project investigates the microbial load on different spices to formulate standards.  
 Report(s) : -  
 Papers Published : -
- 997 Project Title : Pesticide residues on spices: a survey for chlorinated hydrocarbons.  
 Organisation : Central Agmark Laboratory, Nagpur 440 010.  
 Project Category : Applied.  
 Cost : Rs. 3,000/- per annum.  
 Duration : 1981-1984.  
 Sponsor(s) : Agricultural Marketing Adviser to the Govt. of India.  
 Investigator(s) : Nair, K.N.G. and Baiswara, R.B.  
 Description : The project aims to examine samples of various spices at different stages of marketing and investigate whether they contain any chlorinated hydrocarbons. It intends to create confidence among the consumers of Indian spices about the genuineness of the product and its freedom from harmful pesticidal residues.  
 Report(s) : -  
 Papers Published : 1. Sullivan, J.H. Pesticide residues in imported spices. A Survey for chlorinated hydrocarbons. J. Agric. Food Chem. 28(5); 1980; 1031-1034
- 998 Project Title : Plant trials on production of oleoresin using acetone as solvent.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Process Development Discipline.  
 Project Category : Fundamental.  
 Cost : Rs. 4,000/-.  
 Duration : July 1979-August 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Srinivasa Rao, P.N.; Krishnamurthy, N.  
 Description : Plant trials on production of oleoresin from ginger and pepper has been conducted in a working unit. Based on the data collected, the design for one ton/day oleoresin plant incorporating acetone recovery system for adopting in the existing units has been carried out.  
 Report(s) : -  
 Papers Published : -
- 999 Project Title : **Spice oleoresins.**  
 Organisation : Cadbury India Limited, Cadbury House, Bhulabhai Desia Road, Bombay 400 026  
 Project Category : Applied.  
 Cost : Rs. 2,00,000/-.  
 Duration : January 1977-December 1979.  
 Sponsor(s) : Company.  
 Investigator(s) : Shenoy, R.D.; Morde, C.E.  
 \*742
- 1000 Project Title : Post-harvest infestation infection, adulteration and its detection in spices and related foods.  
 Organisation : Regional Research Laboratory, Trivandrum - 19.  
 Project Category : Applied.



- Cost : Rs. 3 lakhs  
Duration : 1979-1983.  
Sponsor(s) : Council of Scientific and Industrial Research.  
Investigator(s) : Sreedharan, V.P.; Mangalakumari, C.K.  
Description : Identification of microbes, pests, and insects in spices, protection of spices from the above organisms by using chemicals which do not have residual action and consumer objections, are attempted. Chromatographic or chemical analysis is adopted for the detection of adulteration in spices.  
Report(s) : -  
Papers Published : 1. Sreedharan, V.P. and others. Staining technique for detection of papaya seeds from black pepper. J. Food Sci. Tech. 18(2); 1981; 65.
- 1001 Project Title : Studies on red pepper, turmeric and garlic with particular reference to their influence on the absorption and metabolism of their active principles.  
Organisation : Central Food Technological Research Institute, Mysore 570013; Biochemistry and Applied Nutrition Discipline.  
Project Category : Fundamental and applied.  
Cost : Rs. 5,49,400/-.  
Duration : April 1979 - March 1982.  
Sponsor(s) : Institute.  
Investigator(s) : Satyanarayana, M.N. and others.  
Description : The project studied: the metabolism of capsaicin and curcumin, the major respective active principles of red pepper and turmeric using cold and labelled compounds in rabbits; the influence of the whole spices and their active principles on gastric and pancreatic secretions; and influence of red pepper/capsaicin and garlic on lipid.  
Report(s) : -  
Papers Published : -
- \*\*995
- 1002 Project Title : Development of continuous cleaning, washing, drying and grading system for black pepper.  
Organisation : Central Food Technological Research Institute, Mysore 570013; Process Development Discipline.  
Project Category : Applied.  
Cost : Rs. 14,000/-.  
Duration : June 1981- September 1981.  
Sponsor(s) : Institute.  
Investigator(s) : Ramanathan, P.K. and others.  
Description : The project evaluates certain available cleaning and washing equipment for their effectiveness; and alternative drying, grading and handling system with a view to reduce cost of plant and energy requirements. It has attempted at the collection of data for setting up a streamlined plant of higher capacity and also preparation of schemes for commercial plants of capacity 500, 1000, 4000 kg per hour.  
Report(s) : Final.  
Papers Published : 1. Ramakrishna, P. and Ramanatham, P.K. Improved cleaning, washing, and drying of pepper. Presented at International Workshop on Pepper Processing and Pepper Products, Mysore, May 1981.
- 1003 Project Title : Design and development of functional and decorative consumer packages for dehydrated tamarind powder.  
Organisation : Central Food Technological Research Institute, Mysore 570 013, Packaging Technology Discipline.

- Project Category : Applied.  
 Cost : Rs. 20,800/-.  
 Duration : October 1978-April 1979.  
 Sponsor(s) : CSIR  
 Investigator(s) : Anandaswamy, B. and others.  
 Description : Packages using several packaging materials were designed and tested. The product packed (250 g and 500 g unit) in 300 guage LDPE and HDPE, and M X X T cello/poly polyester/poly and aluminium foil laminates, and stored at 27 C and 65% RH was acceptable. Under accelerated storage, colour changes were pronounced. In drop tests (from 75 cms) on the above packaging and secondary duplex board cartons, it was found that laminates of polyester/poly, aluminium foil/poly and LDPE possessed better impact strength than HDPE and cello/poly packs. Pouches with the secondary cartons had better resistance to drop impact. The data has established the efficacy of the unit packaging of tamarind powder in flexible packaging and putting them in board cartons for export purposes.
- Report(s) : Final.  
 Papers Published : -
- 1004 Project Title : Quality standardisation dehydrated tamarind powder.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Rice and Pulse Technology Discipline.
- Project Category : Applied.  
 Cost : Rs. 57,900/-.  
 Duration : July 1978-April 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Desikachar, H.S.R. and others.  
 Description : A process was developed to produce dehydrated tamarind powder which can be easily dispensed and thus suitable for household kitchen use. After scale-up studies with batches of 50 kg and 500 kg, the process was made ready for commercial exploitation. The original process was modified to eliminate the caking tendency of dried and pulverised product during storage. Proximate analysis of several market samples was done to study variations in acidity of samples.
- Report(s) : Final.  
 Papers Published : -
- 1005 Project Title : Bael and tamarind concentrates.  
 Organisation : Horticultural Experiment and Training Centre, Basti 272 001.  
 Project Category : Fundamental.  
 Cost : -  
 Duration : 1978-1980.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : -  
 \*744
- 1006 Project Title : Biochemical studies on turmeric.  
 Organisation : Government Fruit Preservation and Canning Institute, 18-B Ashok Marg, Lucknow.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1981/82 - 1982/83  
 Sponsor(s) : Government of Uttar Pradesh  
 Investigator(s) : Surjeet Singh; Tripathi, V.K.



- Description : Different varieties of turmeric grown in Uttar Pradesh will be analysed for their chemical and biochemical characteristics. Efforts will also be made to enhance curcumin contents in commercial varieties by application of some chemicals, so as to identify the varieties with less fibre and more curcumin.
- Report(s) : -
- Papers Published : -
- 1007 Project Title : Effect of NAA and Urea on the oleoresin and fibre content of ginger (*Zingiber officinale*).
- Organisation : Orissa University of Agriculture and Technology; College of Agriculture - Bhubaneswar 751 003; Department of Horticulture.
- Project Category : Applied.
- Cost : -
- Duration : 1975-1979.
- Sponsor(s) : University.
- Investigator(s) : Das, R.C. and others.
- \*745
- 1008 Project Title : Effect of nitrogen and potassium fertiliser on the growth, seed yield and essential oil contents in different cultivars of coriander.
- Organisation : Horticultural Experiment and Training Centre, Chaubattia, Ranikhet, Uttar Pradesh.
- Project Category : Applied.
- Cost : -
- Duration : September 1977 - 1980.
- Sponsor(s) : Centre.
- Investigator(s) : Gupta, L.K.; Shah, S.C.
- \*750
- 1009 Project Title : Survey of existing harvest and post-harvest practices of cardamom to assess the qualitative and quantitative losses.
- Organisation : University of Agricultural Sciences, Hebbal, Bangalore 560024; Harvest and Post-harvest technology scheme.
- Project Category : Survey.
- Cost : -
- Duration : July 1980 - December 1980.
- Sponsor(s) : Indian Council of Agricultural Research.
- Investigator(s) : Babu, C.K. and others.
- Description : -
- Report(s) : AICRP on post-harvest technology annual report 1980 pp.21-36.
- Papers Published : -
- 1010 Project Title : Processing improvements in cardamom technology.
- Organisation : CSIR Trivandrum Complex, Industrial Estate, Trivandrum 695 019
- Project Category : Applied.
- Cost : -
- Duration : 1976-1979.
- Sponsor(s) : Cardamom Board, Cochin.
- Investigator(s) : Mathew, A.G. and others.
- \*751

#### Pickles and Condiments

- 1011 Project Title : Preparation of new recipes and pickles, sausage, etc.
- Organisation : Fisheries Technological Station, Calicut 673 005
- Project Category : Applied.

Cost : -  
 Duration : 1975-  
 Sponsor(s) : Government of Kerala, Directorate of Fisheries.  
 Investigator(s) : -  
 \*755

### Food additives

- 1012 Project Title : Table salt by vacuum crystallisation.  
 Organisation : Central Salt and Marine Chemicals Research Institute, Bhavanagar -2, Gujarat.  
 Project Category : Applied.  
 Cost : Rs. 1,50,000/-.  
 Duration : 1980-1983.  
 Sponsor(s) : Council of Scientific and Industrial Research, New Delhi.  
 Investigator(s) : Sanghavi, J.R. and others.  
 Description : As manufacture of table salt by open pan evaporation is uneconomical particularly in regard to full requirement, vacuum crystallisation has been studied. Laboratory data regarding the process has been established and bench scale experiments are underway in the multiple effect evaporator.  
 Report(s) : -  
 Papers Published : -
- 1013 Project Title : Iron fortification of salt.  
 Organisation : Government of India; Ministry of Agriculture and Irrigation, Krishi Bhavan, New Delhi 110 001; Department of Food; Nutrition Board.  
 Project Category : Applied and Survey.  
 Cost : Rs. 9,00,000/-.  
 Duration : 1977-1979.  
 Sponsor(s) : Food and Nutrition Board.  
 Investigator(s) : Datta, R.N. and others.  
 \*759
- 1014 Project Title : Community studies on iron fortified common salt.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.  
 Project Category : -  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : A study carried out upto 18 months following introduction of fortified common salt showed that prevalence of anaemia was considerably reduced in the villages receiving the fortified salt. It was also seen that there was a significant increase in mean Hb values in all the eight physiological groups studied, namely (1) preschool children (both sexes), (2) boys aged 6-14 years, (3) girls aged 6-14 years, (4) males aged 15-24 yrs (5) females aged 15-24 yrs. (6) adult males aged 25-44 yrs (7) adult females aged 25-44 yrs and (8) males and females above 44 yrs. The studies were extended for a further period of six months to find out whether the beneficial effect would further increase. The results were positive and confirmed the earlier findings. Further studies are continuing with the same experimental group by withdrawing the fortified salt and introducing crushed unfortified salt under controlled conditions in order to find out the effect of withdrawal of fortified salt on haemoglobin levels and prevalence of anaemia in the community.



- Report(s) : -  
 Papers Published : 1. Nadiger, H.A. and others. Use of common salt (sodium chloride) fortified with iron to control anaemia: results of a preliminary study. British J. Nutr. 43; 1980; 45-51
- 1015 Project Title : Studies on guar and other gums and their use in food preparations.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Biochemistry and Applied Nutrition Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 1,55,930/-.  
 Duration : May 1978-April 1981.  
 Sponsor(s) : Institute.  
 Investigator(s) : Wankhede, D.B.  
 Description : Galactomannan was isolated from Durgapur Saphed guar seeds by wet processing methods using 2 per cent sodium bicarbonate solution at 100 C. The rheological properties such as viscosity as a function of temperature, pH, concentration and different shear rates were studied. The interactions of different salts (mono-di and polyvalent) with guar gum solution as also the functional properties of gum such as water holding capacity, suspending ability, fat absorption and emulsion stability were investigated. Results showed that guar gum functions as a good suspending agent at levels of 0.75 to 1.00 per cent.  
 Report(s) : Final.  
 Papers Published : -
- 1016 Project Title : Development of cocoa butter substitutes for confectionery.  
 Organisation : Harcourt Butler Technological Institute, Kanpur 208 002.  
 Project Category : Applied.  
 Cost : Rs. 50,000/-.  
 Duration : June 1977-1980.  
 Sponsor(s) : Government of Uttar Pradesh.  
 Investigator(s) : Vasishtha, A.K.; Shukla, M.  
 \*763
- 1017 Project Title : Emulsifiers for bakery products.  
 Organisation : Britannia Biscuit Company Limited 'Nirmal' 20th Floor, Nariman Point, Bombay 400 021; Research And Development Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : March 1978-February 1979.  
 Sponsor(s) : Company.  
 Investigator(s) : Narang, N.T.; Naik, S.V.  
 \*770
- 1018 Project Title : Flavour developments for bakery foods.  
 Organisation : Britannia Biscuit Company Limited, 'Nirmal', 20th Floor, Nariman Point, Bombay 400 021; Research and Development Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : March 1978- February 1979.  
 Sponsor(s) : Company.  
 Investigator(s) : Krishnaswamy, S.V. and others.  
 \*772
- 1019 Project Title : Studies on aroma recovery from some fruits and preparation of products after reconstitution.

- Organisation : Central Food Technological Research Institute, Mysore 570013;  
 Fruits and Vegetable Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,91,000/-.  
 Duration : April 1979 - March 1981.  
 Sponsor(s) : Institute.  
 Investigator(s) : Patwardhan, M.V. and others.  
 Description : Aroma recovery unit supplied by KFA (West Germany) was tried  
 with various fruits and found unsuitable for several. There-  
 fore, a modified unit was developed. This unit has a capacity  
 of 1500 kg/hr (pineapple). Aroma concentrates prepared using  
 this unit were also evaluated. Encapsulation of the concentra-  
 tes was also studied.  
 Report(s) : -  
 Papers Published : -
- 1020 Project Title : Storage stability of aroma and juice concentrates from tro-  
 pical and temperate fruits.  
 Organisation : Central Food Technological Research Institute, Mysore 570013;  
 Project Category : Applied.  
 Cost : Rs. 4,91,480/-.  
 Duration : April 1981 - March 1983.  
 Sponsor(s) : Institute.  
 Investigator(s) : Eipeson, W.E. and others.  
 Description : Aroma concentrate from two varieties of mangoes viz.  
 Alphonso and Totapuri were prepared. The aroma removed pulps  
 were concentrated to about twice their initial solids con-  
 tents. The concentrated pulps on reconstitution with aroma con-  
 centrates and dilution to fresh pulp concentration showed  
 that they are identical to fresh pulps with respect to fla-  
 vour, taste, colour and consistency. Organoleptic evaluation  
 of ready-to-serve beverages prepared from concentrated pulps  
 incorporating different levels of aroma concentrates indi-  
 cated that 50% aroma level is comparable to those prepared  
 from fresh pulps.  
 Report(s) : -  
 Papers Published : -
- 1021 Project Title : Preparation of reconstituted synthetic essential oils, fla-  
 vour blends and encapsulation of flavour.  
 Organisation : Central Food Technological Research Institute, Mysore 570013;  
 Plantation products and Flavour Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 6,09,800/-.  
 Duration : January 1982 - December 1984.  
 Sponsor(s) : CSIR  
 Investigator(s) : Shankaranarayana, M.L. and others.  
 Description : Terpeneless lemon oil showed the presence of citral, dode-  
 cinal terpeneol, linaleol, geranyl acetate, acetylacetate and  
 terpinen 4-ol. Six trace compounds in asafoetida volatile  
 oil were identified as dimethyl trisulphide, 2-butyl methyl  
 disulfide, 2-butyl methyl trisulphide, di-2-butyl disulfide,  
 di-2-butyl trisulfide and di-2-butyl tetra sulfide. Encapsu-  
 lation of orange, ginger, lime and lemon oils was carried  
 out using gelatin and sugars as carriers. The sugar encap-  
 sulated flavours were found useful in dry beverage mixes.  
 Cis-trans isomers of the compounds, viz., 1(methylthio)  
 propyl propenyl disulfide and 2-butyl-3(methylthio)allyl  
 disulfide were separated by HPLC. The spectral and physical  
 characters of these isomers are being studied. Butyl sulphide



(prepared by oxidation of butanethiol with ferric acid and methanol) possessed a flavour note at higher dilution resembling asafoetida volatile oil. Studies are also underway to prepare analogous synthetic disulfides. A modified version of Likens-Nickerson's apparatus was fabricated to extract aroma components in different foods.

Report(s) : -

Papers Published : 1. Abraham, K.O. and others. Asafoetida. VII. Isolation and identification of odourous compounds. Indian Food Pack. 36(5); 1982; 40  
2. Manjunath and others. Asafoetida - a simplified method for the determination of alcoholic extract. Indian Food Pack. 35(4); 1981; 36

1022 Project Title : Utilization of terpenes from citrus oils.  
Organisation : Central Food Technological Research Institute, Mysore 570013; Plantation Products and Flavour Technology Discipline.  
Project Category : Applied.  
Cost : Rs. 8,88,235/-.  
Duration : November 1976 - April 1980.  
Sponsor(s) : Institute.  
Investigator(s) : Ravindranath, B. and others.  
Description : D-Limonene forms 90% of the terpene hydrocarbons of citrus and peel oils and can be converted into useful flavouring compounds. Experiments in this direction have led to some new reactions and in some cases better understanding of some known reactions. It was found that tertiary allyl halides could be converted into corresponding alcohols, esters and ethers in presence of lime oxide. Using this reaction several substances (e.g. L-terpineol, its acetate and other esters) were prepared and successfully tried as flavour compounds. These procedures are being patented. A simple reagent for use for deoxygenation was discovered. This can also substitute for the Wittig reaction for the synthesis of vitamin A and carotenoids. A new method for conversion of limonene into L-terpineol based on direct hydration using ion-exchange resins was also developed.

Report(s) : Final.

Papers Published : 1. Ravindranath, B. Some useful products from limonene a by-product of citrus industry. Presented at Symposiums on By-products from Food Industries: Utilization and Disposal, Mysore, May 1980.  
2. Ravindranath, B. Some useful products from limonene: A by-product of the citrus industry. J. Sci. Indus. Res. 42(2); 1983; 82

\*771

1023 Project Title : Encapsulated flavours.  
Organisation : Department of Chemical Technology, University of Bombay, Matunga Road, Bombay 400 019.  
Project Category : Applied.  
Cost : Rs. 7,000/- per year.  
Duration : Two years.  
Sponsor(s) : University Grants Commission, New Delhi.  
Investigator(s) : Ramalingam Laxmi; Kulkarni, P.R.  
Description : Encapsulation of flavours using low temperature conditions are being standardised.  
Report(s) : -  
Papers Published : -

- 1024 Project Title : Studies on the utilisation of natural plant pigments as food colourants.
- Organisation : Central Food Technological Research Institute, Experiment Station, Industrial Estate, Sanat Nagar, Hyderabad 570 018.
- Project Category : Developmental.
- Cost : Rs. 1,38,640/-.
- Duration : November 1977 - October 1979.
- Sponsor(s) : CSIR
- Investigator(s) : Venkateshwara Rao, M. and others.
- Description : Methods were worked out for preparing refined annato dye powder. Different dye formulations like water soluble acid soluble and oil soluble were also prepared from refined annato powder. The acid dye, at a concentration of 0.5-0.6%, was found adequate to impart attractive yellow colour to lime squash and the dye did not separate in such high acid medium during storage. Fresh and dried peel and pulper waste or Banashan mangoes were also studied for their pigment contents. The fresh peel and pulper waste contained 220 mg and 83 mg/100 g of total carotenoids, which in the dry peel were 116 mg and 37 mg/100 g respectively, indicating significant loss of carotenoids during drying. Blanching caused higher carotencid loss.
- Report(s) : Final.
- Papers Published : -
- \*777
- 1025 Project Title : Nature of pigment constituents of made tea.
- Organisation : Tocklai Experiment Station, Jorhat 785 008, Assam/
- Project Category : Fundamental.
- Cost : -
- Duration : 1973-1986.
- Sponsor(s) : Tea Research Association.
- Investigator(s) : Ravindranath, S.D. and others.
- Description : Extraction, isolation and identification of a fraction of the-arubigins from tea is being experimented. Elucidation of the structure of thearubigins is also envisaged.
- Report(s) : Annual Scientific Report.
- Papers Published : -
- 1026 Project Title : Tea pigments as food colourants.
- Organisation : Tea Research Association; Tocklai Experiment Station, Jorhat 785 008
- Project Category : Fundamental and applied.
- Cost : -
- Duration : -
- Sponsor(s) : Tea Research Association.
- Investigator(s) : Ravindranath, S.D. and others.
- Description : Tea and tea waste are rich in orange and reddish pigments. By laboratory-scale extraction, three pigments were isolated and one of them was water soluble. The pigments are currently evaluated toxicologically by ITRC, Lucknow.
- Report(s) : Annual.
- Papers Published : -
- 1027 Project Title : Natural food colours and their application in foods.
- Organisation : Central Food Technological Research Institute, Mysore 570013; Plantation Products and Flavour Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 3,03,800/-.



- Duration : April 1980 - March 1983.  
 Sponsor(s) : Institute.  
 Investigator(s) : Lewis, Y.S.; and others.  
 Description : Studies on extraction of colour from fresh Kokum fruits were carried out. The acid in Kokum was identified as hydrooxycitric acid and the anthocyanin pigments were cyanidin-3-glucoside and cyanidin xylosyl-glucoside. In studies with grape colour concentrate, it was found that treatment with yeast increased the colour concentration while enzyme treatment reduced viscosity without affecting colour. The stability of Kokum and safflower colour in syrups, squashes and jams was evaluated. Laboratory trials for the recovery of acid, anthocyanins and garcinol from Kokum fruit was carried out. A method was also developed for removal of off-odour from safflower colour concentrate.
- Report(s) : Consolidated report.  
 Papers Published : 1. Sampathu, S.R. and others. Natural food colours. Indian Fd. Packer. 35(2); 1981; 97.  
 2. Shankaranarayana, R. and others. How safe are safe food colours. Paper presented at the Symposium on food colours.  
 3. Shankaranarayana, R. Food colours. Indian Food Packer. 35(3); 1981; 1  
 4. Krishnamurthy, N. and others. On the structures of gongcinol, isogarcinol and camboginol. Tetrahedron letters. 22(8);1981;793  
 5. Krishnamurthy, N. and others. Crystal and molecular structure of isogarcinol. Tetrahedron Letters 23(21);1982;2233  
 6. Krishnamurthy, N. and others. Chemical constituents of kokum fruit rind. J. Fd. Sci.Tech. 19; 1982; 97  
 7. Sampathu, S.R. and Krishnamurthy, N. Processing and utilisation of kokum. Indian Cocoa, Arecanut and Spic.J. 6(1);1982;12
- 1028 Project Title : Natural food utilisation of natural pigment for colouring.  
 Organisation : Central Food Technological Research Institute, Mysore 570013, Plantation Products and Flavour Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs.2,26,000/-.  
 Duration : October 1976-March 1980  
 Sponsor(s) : CSIR  
 Investigator(s) : Lewis, Y.S. and others.  
 Description : The yields of colour from Bangalore blue grape skin, safflower petab, Kokum fruit, beet root, Parijatha corolla tubes, Gulmohar and Hibiscus sabdariffa callyses were determined. Scale up data were collected for colour extraction from blue grape skin, safflower, Kokum and beet root. A non fermentative method for producing beet root colour concentrate was developed using 50 kg batches in view of the higher pigment losses in the fermentative method. Vegetable colourants in powder form were prepared in 1-2 kg batches. These powders were found stable at room temperature in air tight containers. The problem of caking could be overcome by use of in-pack dessicants or anticaking agent. After testing the stability of powder in alcohol, they were tried for use in alcoholic beverages and processed fruit and vegetable products successfully. Effort were also made to refine the colour concentrates by getting them rich in sugars, proteins, pectin etc. as some unrefined concentrates create problems such as precipitation and sedimentation in beverages and off taste and off-odours in food products because of high dosage required.
- Report(s) : Final.  
 Papers Published : 1. Krishnamurthy, N. and others. Chemical properties of kokum fruit rind. J. Food Sci. Technol. 19; 1982; 97

2. Prabha, T.N. and others. Anthocyanins of avocado peel. J. Food Sci. Technol. 17; 1980; 241.
3. Sampathu, S.R. and others. Natural Food Colours. Indian Food Pack. 35(2); 1981; 97.
4. Sampathu, S.R. and others. Natural Food Colours. Presented at Annual Meeting of All India Food Preservation Association New Delhi, November 1980.
5. Sampathu, S.R. and Krishnamurthy, N. Processing and utilisation of kokum fruit rind. J. Cocoa Spices Arecanot 6(1); 1982; 12)
6. Shankaranarayana, R. and others. How safe are safe food colours. Presented at Symposium on Food colours, Madras, 1980.

- 1029 Project Title : Utilization of plant pigments as food colours.
- Organisation : Bhabha Atomic Research Centre, Bombay 470085.
- Project Category : Applied.
- Cost : -
- Duration : 1978-1979
- Sponsor(s) : Centre
- Investigator(s) : Oke, M.S. and Thomas, P.
- Description : The water soluble flavonoid pigments extracted from Butea frondosa L. flavours was found to be a good substitute as a food colourant in the yellow-orange range in place of synthetic coal tar colours. The major pigment, isobutrin showed good stability under varying-conditions of pH, heat and light. However, in presence of SO<sub>2</sub> and ascorbic acid the pigment showed relatively poor stability.
- Report(s) : -
- Papers Published : Chalcoures from Butea frondosa L. flavour extract as yellow food colourants. Oke, M.S. and others. J. Food Sci. 45; 1980; 746-7
- 1030 Project Title : Studies on use of natural colourants in processed foods.
- Organisation : Central Food Technological Research Institute, Mysore 570013, Fruits and Vegetable Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 1,20,000/-.
- Duration : February 1980-February 1982.
- Sponsor(s) : Institute.
- Investigator(s) : Sastry, L.V.L.; Rajni Padival, A.
- Description : Colours from safflower, Kokum and beet root were studied for stability and behaviour in model system and fruit juices and squashes. The quantities of these colourants need to match a particular shade produced by synthetic colourants were comparatively high. Safflower colour was fairly stable, Kokum colour faded during storage and beet root colour turned brownish yellow to pale yellow during storage.
- Report(s) : -
- Papers Published : -
- 1031 Project Title : Toxicological evaluation of some selected natural food colours.
- Organisation : Central Food Technological Research Institute, Mysore-570013; Animal House.
- Project Category : Applied.
- Cost : Rs. 11,200/-.
- Duration : September 1980-March 1984.
- Sponsor(s) : Institute.
- Investigator(s) : Radhakrishna Murthy, R. and others.
- Description : Natural food colours such as those from safflower, Kokum, etc. are being studied for factors such as oral toxicity using albino rats. Haematological and histopathological tests conducted so far



have not revealed any pathology. Food intake, animal behaviour and weight remained normal. In the case of kokum colour, however slight erosion in the intestine villi with garcinol and cyanadin, and mild cellular infiltration in the kidney (of female mice) with cyanadin.

Report(s) : -  
Papers Published : -

1032 Project Title : Evaluation of lac dye as a food colouring agent.  
Organisation : All India Institute of Hygiene and Public Health, 110 Chittaranjan Avenue, Calcutta 700 073.  
Project Category : Applied and Explanatory.  
Cost : Rs.50,000/- per year.  
Duration : 1980-1983.  
Sponsor(s) : Indian Council of Medical Research.  
Investigator(s) : Indira Chakravathy and others.  
Description : Crude lac obtained from the secretions of an insect is purified for preparation of Shellac. During the purification process, a red coloured, water soluble, natural dye known as lac dye leaches out with water, which is being wasted. This project aims to use this dye as a food colouring agent. Toxicity studies are being conducted on monkeys. Lac dye has proved to be relatively non-toxic compared to the other industrially prepared synthetic red dyes.

Report(s) : -  
Papers Published : -

1033 Project Title : Nutritive value of less familiar foods: Gum Karaya (Indian Tracaganth).  
Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : ICMR  
Investigator(s) : -

Description : Gum Karaya is an exudate from a tree, Sterculia ureus and has a very high water absorption capacity. It finds wide application as an emulsifier and stabiliser in food industries of developed countries particularly in ice cream industry. Preliminary studies were therefore conducted to determine its chemical composition. It was shown that the gum contained **very little protein (0.9%), fat (0.2%) and available carbo-**

hydrate (practically no starch). However, it had a high proportion of unavailable carbohydrates (70%), total ash ( %), Ca (777 - 978 mg/ 100 g ) and iron (27 - 32/100 g). Further studies on the chemical composition and toxicological evaluation are underway.

Report(s) : Annual.  
Papers Published : -

### Food habits

- 1034 Project Title : Study on food habits.  
Organisation : Kerala Agricultural University; College of Agriculture, Vellayani, Trivandrum 695 522; Department of Agricultural Extension, Food Science and Nutrition Section.  
Project Category : Survey.  
Cost : Rs. 300/-.  
Duration : 1978-1984.  
Sponsor(s) : University.  
Investigator(s) : Menon, A.G.G.; Vimalakumari, N.K.  
Description : The project attempts to find out the food consumption pattern of the people of Kerala and to study the attitude of people towards various foods. A study on the impact of various agencies in changing food habits is also being conducted.  
Report(s) : -  
Papers Published : -  
\*958
- 1035 Project Title : Consumer concept of food products for product development to identify product profiles and project consumer acceptance.  
Organisation : Central Food Technological Research Institute, Mysore 570013; Sensory Evaluation Discipline.  
Project Category : Applied.  
Cost : Rs. 1,58,000/-  
Duration : June 1980 - March 1982.  
Sponsor(s) : Institute.  
Investigator(s) : Rajalakshmi, D. and others.  
Description : Attempts were made to identify consumer concepts for a variety of food products like Roti, Tandoori chicken, fruit beverages, confectionery products, etc. by objective, by application of methods such as magnitude estimation, principal component analysis and multi-dimensional scaling. Based on the results obtained, efforts were made to project the demand potential for a variety of products.  
Report(s) : -  
Papers Published : 1. Govindarajan, V.S. Optimising sensory evaluation. ISI Bulletin. 32(12); 1980; 58
- 1036 Project Title : Consumer concept identification and multivariate data exploration for profiling of products and projection of consumer acceptance.  
Organisation : Central Food Technological Research Institute, Mysore-570013; Sensory Evaluation Discipline.  
Project Category : Applied.  
Cost : Rs. 1,01,700/-.  
Duration : July 1982 - June 1983.  
Sponsor(s) : Institute.  
Investigator(s) : Rajalakshmi, D. and others.  
Description : Work on i) cocoa and its products and ii) cereal based products were taken up. The colour appearance, texture, aroma, taste and



after taste of chocolates were identified and evaluated. Instrumental colour measurements were taken and expressed in the CIE system for the computation of which a programme was also developed to be used on the Microprocessor-1121. The instrumental measures of texture were recorded from shear-cum-compression tests on Instron (Model-1140) for correlating and validating with sensory measures.

Report(s) : -  
Papers Published : -

1037 Project Title : Pattern of food consumption by age in Andhra Pradesh.  
Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.  
Project Category : Survey.  
Cost : -  
Duration : -  
Sponsor(s) : ICMR  
Investigator(s) : -  
Description : The survey has shown that cereals and millets form the major articles of two contributing to many of the important nutrients among different age groups. The increased demand of nutrients with increasing age is generally met by increasing the consumption of cereals and millets rather than protective foods.

Report(s) : Annual.  
Papers Published : -

1038 Project Title : Socio-economic status and nutrient intake.  
Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.  
Project Category : Survey.  
Cost : -  
Duration : -  
Sponsor(s) : ICMR  
Investigator(s) : -  
Description : Data were collected during 1975-78 about 8300 families on societal status (caste), occupation, land holdings and extent of their utilisation, possession of cattle and other assets as parameters to determine their economic status and related to their protein-calorie intakes. It was found that dietary status of households belonging to labourers and landless class and those having lands but not raising crops, having no cattle, and belonging to Harijan and tribal groups was less satisfactory as compared to cultivators and other groups.

Report(s) : Annual.  
Papers Published : -

## 6. Fats and Oils

1039 Project Title : Safety of solvent extracted oils and other foods from polynuclear hydrocarbons.  
Organisation : Central Food Laboratory, 3, Kyd Street, Calcutta 700 016.  
Project Category : Applied and Survey.  
Cost : -  
Duration : 1976-  
Sponsor(s) : Laboratory.  
Investigator(s) : Roy, B.R. and others.  
\*784

1040 Project Title : Fractionation of fats and their melting dilations.  
Organisation : Nagpur University; Laxminarayan Institute of Technology, Nagpur 440 100  
Project Category : Applied.

Cost :  
 Duration : 1977-  
 Sponsor(s) : University.  
 Investigator(s) : Rao, C.V.N. and others.  
 Description :  
 Report(s) :  
 Papers Published :  
 \*786

1041 Project Title : Fractionation and modification of sal fat to meet the specific requirement of the food processing industry.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Lipid Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs.77,600/-.  
 Duration : October 1978-September 1980.  
 Sponsor(s) : CSIR  
 Investigator(s) : Prabhakar, J.V. and others.  
 Description : A sal fat fraction resembling cocoa butter in properties such as iodine value, cooling curve and dilation values was prepared by solvent winterisation. Further work showed that lower solvent ratios could be used to obtain sal fat fractions exhibiting cooling curves similar to those obtained by employing high solvent ratio. The sal fat fraction prepared by the conventional dry fractionation did not show uniform yields and varied in physical properties. It was found that the the sal fat fraction obtained by solvent winterisation was compatible with cocoa butter at 25% level.  
 Report(s) : Final.  
 Papers Published : 1. Hemavathi, J. and Sen. D.P. Fractionation of and modification of mango kernels and sal fat for use in foods. Presented at the First Indian Convention of Food Scientists and Technologists, Mysore, June 1978.  
 2. Hemavathi, J. and Sen, D.P. Sal fat and its modification. Presented at the symposium on production and utilisation of Forests products at RRL, Jammu, March 1979.  
 3. Nasirulla and others. Shorea robusta (Sal) fats: a compositional and physicochemical study. Presented at Annual convention and Symposium on Processing of Oilseeds, By-products and Derived Products, Hyderabad, February 1981.  
 4. Yella Reddy, S. and Prabhakar, J.V. Effect of oleic acid and glyceryl monostearate on the solidification properties of sal fat. Presented at Ahara 82: International Food Conference, Bangalore, May 1982.

\*793

1042 Project Title : Preparation of vanaspati like fat by interesterification.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Lipid Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs.54,300/-.  
 Duration : August 1977-July 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Sen,D.P. and others.  
 Description : A vanaspati-like product was prepared by interesterification of a) refined and hydrogenated groundnut oil b) refined groundnut oil and lard c) refined groundnut oil and sal fat d) refined safflower oil and refined vegetable oil and e) refined cottonseed



oil. Stability of interesterified oils was the same as the corresponding blends/oil at 30 C above which they were less stable. Addition of BHA improved stability. There was increased in vitro digestibility and molecular redistribution of fatty acids leading to gradual increase in triglyceride molecules. The products decreased serum lipids in hypercholesterolemic rats. Snacks like potato chips, cake, biscuit and halwa were acceptable and comparable to those prepared with vanaspati.

Report(s) : Final.  
 Papers Published : 1. Grace George and Sen, D.P. Studies on interesterification of fat. Presented at the International Congress on Oilseeds and Oils, Oil Technologists Association of India, New Delhi, January 1979.  
 2. Grace George and Sen, D.P. Blending and interesterification of sal fat with groundnut oil. Presented at the Symposium of Oilseeds, Byproducts and Derived Products: Technoeconomic Aspects, RRL, Hyderabad, February 1981.

\*787

1043 Project Title : Chemistry and technology of sal fat (Shorea robusta).  
 Organisation : Hindustan Lever Limited; Research Centre, Chakala, Andheri East, Bombay 400 099.  
 Project Category : Fundamental and applied.  
 Cost : -  
 Duration : 1970-1982.  
 Sponsor(s) : Company.  
 Investigator(s) : Bringi, N.V. and others.  
 Description : The project is concerned with the study of total chemistry of sal fat and developing suitable technology to upgrade it for use in edible products particularly confectionery. Large quantities of sal fat have been processed and exported for formulating cocoa butter substitutes. Currently, new technology is being developed to meet the exacting standards of the importing countries.

Report(s) : -  
 Papers Published : 1. Bringi, N. and others. Fatty acid and triglyceride composition of Shorea robusta fat. Occurrence of cis 9:10-epoxy stearic acid and thero, 9:10-dihydroxy stearic acid. Chemistry and Industry. 1972; 805  
 2. Kolhe, J.N. and others. Occurrence of 3-keto triterpenes in the unsaponifiable matter of sal. Lipids. 16(10); 1981; 775-776  
 3. Bringi, N. and others. Occurrence of 3-oxotriterpenes in the unsaponifiable matter of some vegetable fats. Lipids. 17(3); 1982; 166-168

\*792

1044 Project Title : Preparation and evaluation of sucroglycerides.  
 Organisation : Central Food Technological Research Institute, Experiment Station, Hyderabad.  
 Project Category : Applied.  
 Cost : Rs. 56,200/-.  
 Duration : August 1979 - January 1981.  
 Sponsor(s) : CSIR  
 Investigator(s) : Venkateswara Rao, M.; Giridhar, N.  
 Description : Samples of sucrose palmitate and sucrose stearate were prepared mutual sal fat, mango kernel fat and palm oil, using dimethyl formamide as a mutual solvent and a precipitant for unreacted sugar and transesterified in the presence of a specific catalyst.

TLC revealed the formation of maximum mono-and di-esters which was desirable in the glycerides. The HLB values of the glycerides were found to be from 5 to 8. The melting point varied from 37 to 51 C which conform to normal values. The studies pointed out the feasibilities of the process of production of sucro-glycerides by direct transesterification of triglycerides and sucrose.

Report(s) : Final  
 Papers Published : 1. Giridhar, N. and Venkateswara Rao, M. Preparation and application of sucrose esters. Presented at First International Symposium on Cashew, Cochin, March 1979.

1045 Project Title : Storage and handling of Sal seeds and kernels.  
 Organisation : Central Food Technological Research Institute, Lipid Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 74,300/-.  
 Duration : June 1979 - June 1981.  
 Sponsor(s) : CSIR  
 Investigator(s) : Sen, D.P. and others.  
 Description : Current practices of collection, handling and storage of sal seed kernel in the growing areas were studied. Sal seed kernels with or without fumigation (ethyl formate, phosphine, methyl bromide and ethylene dibromide) were stored in gunny bags at ambient temperatures (25-32 C). Upto 5 months, both treated and untreated samples had more or less same FFA content (1.7-2.7%). In subsequent months treated samples had lower FFA content than untreated ones. At 5 months of storage, epoxy content was nil while dihydroxy stearic acid content was found to be 1-2%. Untreated samples showed higher infestation by Sitophilus linearis and Tribolium castaneum.  
 Report(s) : Final.  
 Papers Published : 1. Ramanna, B.R. and others. Epoxy acid content of Sal fat extracted from freshly harvested and stored kernels. Presented at Symposium on Processing of Oilseeds, By-products and Derived Products: Technological Aspects., RRL, Hyderabad, February 1981).

1046 Project Title : Edibility of mango fat and sal fat.  
 Organisation : University of Madras, Guindy Campus, Madras 600 025; Department of Biochemistry.  
 Project Category : Fundamental and applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : University.  
 Investigator(s) : Shanmugasundaram, E.R.B.  
 Description : Nutritional and biochemical studies on mango and sal seed fats are being conducted.  
 Report(s) : -  
 Papers Published : 1. Radhakrishnan, V. and others. Nutritional properties of mango kernel fat relative to some edible oils. Nutrition Reports International; 24(4); 1981; 747.  
 2. Shanmugasundaram, E.R.B. and others. The effect of feeding mango kernel fat on blood lipids and lipoproteins of rats. Nutrition Reports International. 25(4); 1982; 697



- 1047 Project Title : Confectionery fats from newer oils.  
 Organisation : Cadbury India Limited, Cadbury House, Bhulabhai Desai Road, Bombay 400 026.  
 Project Category : Applied.  
 Cost : Rs. 15,00,000/-.  
 Duration : June 1974 - December 1980.  
 Sponsor(s) : Company.  
 Investigator(s) : Shenoy, R.D. and others.  
 \*797
- 104 Project Title : Development of low-calorie protein-rich table spread.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977-1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Patel, A.A.; Gupta, S.K.  
 \*798
- 1049 Project Title : Studies on refining and fractionation of vegetable fats to obtain cocoa butter substitutes.  
 Organisation : Perarignar Anna University of Technology; Alagappa Chettiar College of Technology, Guindy, Madras 600 025; Department of Chemical Engineering.  
 Project Category : Applied.  
 Cost : -  
 Duration : September 1979 - Continuing.  
 Sponsor(s) : University.  
 Investigator(s) : Laddha, G.S. and others.  
 Description : The objective of this M. Tech. Degree project is to obtain fats with characteristics similar to cocoa butter from natural fats such as mango kernel fat, sal fat, dhupa fat, etc. by subjecting them to refining, and chemical and physical modifications. Preliminary work indicated that solvent fractionation was a good method to obtain the products. Before fractionation, depending on the type and nature of the fat, refining was carried out by conventional or solvent refining technique. Simple solvent fraction as well as combination of chemical modification and solvent fraction yielded products similar to cocoa butter. Fractionation of palm oil was also attempted. Studies which are in progress will be extended to other natural fats available in the country.  
 Report(s) : -  
 Papers Published : Several M.Tech. theses on different aspects of the project.
- 1050 Project Title : Nutritional and toxicological studies on Kokum, Dhupa, mango kernel and sunhemp seed fat.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Biochemistry and Applied Nutrition Discipline  
 Project Category : Applied.  
 Cost : Rs. 1,80,935/-.  
 Duration : April 1978 - March 1981.  
 Sponsor(s) : Institute.  
 Investigator(s) : Shurpalekar, K. and others.  
 Description : It was found that Kokum and Dhupa fats contained 55.9% and 41% of stearic acid respectively. Oleic and palmitic acids were the other major fatty acids. The FFA contents were 0.72 and 14.82% respectively. Nutritional studies on Kokum and mango fat indicated that only Kokum fat affected growth rate in rat. The digestibilities of both fats were lower than that hydrogenated vegetable oil.

Report(s) : Final.  
 Papers Published : -  
 4/96

1051 Project Title : Nutritional studies on Kokum, Dhupa and mango kernel fat and development of an oil based emulsion for parenteral nutrition.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Biochemistry and Applied Nutrition Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 1,31,608/-.  
 Duration : April 1981 - March 1983.  
 Sponsor(s) : Institute.  
 Investigator(s) : Raina, P.L. and others.  
 Description : The fractionation of free lipid of dhupa, kokum and sunhemp lipid on silicic acid column and their fatty acid profile are studied. Neutral lipid comprises about 85.92% of total followed by glycolipids. (3-8%) Phospholipids were minor components. Palmitic, stearic and oleic acids were the only fatty acid present in different lipids of dhupa. Sunhemp lipid showed fairly high amounts 45% of linoleic acid in bound, strongly bound and very strongly bound lipids. Decreasing the levels of Ca in the diet improved the digestability of mango fat significantly whereas that of kokum fat remained unchanged.  
 Report(s) : Annual.  
 Papers Published : 1. Sunderavalli, O.E. and Shurpalekar, K.S. Nutritional evaluation of kokum (*Garcinia indica*) and mango (*Mangifera indica*) fat. J. Oil Technol. Assoc. 13; 1981; 116.

1052 Project Title : Quality changes in deep fat fried products.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Lipid Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 2,32,000/-.  
 Duration : May 1979 - April 1981.  
 Sponsor(s) : CSIR  
 Investigator(s) : Sen, D.P. and others.  
 Description : Several deep fried traditional products were studied to observe changes in chemical compounds of oils during frying. Results indicated that the damaged components of lipids extracted from the product were lesser than in the corresponding frying oil.  
 Report(s) : Annual.  
 Papers Published : 1. Ramanna, B.R. Oxygenated fatty acids in fats, oils and fatty foods. M.Sc. (Food Sci.) Thesis, University of Mysore, 1981.  
 2. Sulthana, S.N. Studies on frying of foods in Oils. Ph.D. Thesis, University of Mysore, 1982.  
 3. Sulthana, S.N. and others. Quality of oil in frying media and deep fat fried product. Presented at First Indian Convention of Food Scientists and Technologist, Mysore, June 1983.  
 4. Sulthana, S.N. and Sen, D.P. Studies on deep fat frying changes during heating of oil. J. Food Sci. Technol. 16; 1979; 208  
 5. Sulthana, S.N. and Sen, D.P. Quality of lipids in deep fat-fried products. Presented at the 72nd Annual Meeting of AOCS, New Orleans.

1053 Project Title : Studies on deep fat frying of foods to reduce fat uptake by the fried product and to increase frying life of oil.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Lipid Technology Discipline.



- Project Category : Applied.  
 Cost : Rs. 2,23,800/-.  
 Duration : April 1981 - April 1983.  
 Sponsor(s) : Institute  
 Investigator(s) : Prabhakar, J.V and others.  
 Description : Various fried products were examined for absorption of oxidised and polymerised components of frying fats during frying. Non urea adducts forming fatty acids served as an index in the case of finger chips. Heat stability of blends of oils (example: sesame + soy bean oil at a ratio of 1:1) was also studied. Individual oil (sesame) was more stable than the blend in free and oxidised fatty acid. Effect of wax on oil uptake was also studied.
- Report(s) : Final.  
 Papers Published : -
- 1054 Project Title : Study of aflatoxin content in the market samples of edible oils.  
 Organisation : Central Food Technological Research Institute, Experiment Station, Lucknow 226 001.  
 Project Category : Fundamental.  
 Cost : Rs. 11,150/-.  
 Duration : September 1979 - August 1980  
 Sponsor(s) : Institute.  
 Investigator(s) : Bisht, H.C.; Saha, N.K.  
 Description : Samples of edible oils were collected from retail shops and expellers situated in various markets of Lucknow and were screened for the presence of aflatoxin by the aqueous-acetone extraction method. Out of 136 samples of mustard oil tested, 53 were found to contain aflatoxin. No sample of soybean oil, til oil and rapeseed oil contained aflatoxin while as many as 25 out of 38 samples of groundnut oil were found to contain aflatoxin.
- Report(s) : -  
 Papers Published : -
- 1055 Project Title : Storage study on mustard, coconut, sesame and sunflower oil development/improvement of methodology for analysis of vegetable oils.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Analytical Quality Control Laboratory.  
 Project Category : Applied.  
 Cost : Rs. 30,000/-.  
 Duration : July 1982 - July 1983.  
 Sponsor(s) : Institute.  
 Investigator(s) : Kapur, O.P. and others.  
 Description : Coconut oil stored below 37 C in clear bottles as well as coloured bottles showed no change in refractive index, FFA and iodine while above 37 C FFA content increased. Mustard, sesame and sunflower (refined) oils stored in at 37 C showed increased FFA contents with no change in iodine value. Rancidity measurements were also carried out.
- Report(s) : -  
 Papers Published : -
- 1056 Project Title : Argemone oil: Toxicity and analysis.  
 Organisation : Central Food Laboratory, 3 Kyd Street, Calcutta 700 016.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1970-  
 Sponsor(s) : Laboratory.  
 Investigator(s) : Bose, P.K.

1057 Project Title : Processing of rice bran and rice bran oil for edible purposes.  
 Organisation : Central Food Technological Research Institute, Mysore 570013;  
 Lipid Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 99,300/-.  
 Duration : July 1978 - December 1980.  
 Sponsor(s) : CSIR  
 Investigator(s) : Sen, D.P. and others.  
 Description : Laboratory conditions were determined for classification, de-  
 gumming, alkali refining, bleaching, dewaxing and deodourisa-  
 tion of crude rice bran oil (FFA, 4.2%). The total loss during  
 processing was about 22%. Refined oil had light colour and  
 bland odour. The composition was phospholipids, 0.2%, FFA, 0.30;  
 wax 0.02%; and unsaponifiable matter, 2.6%. In studies on che-  
 mical stabilisation, ammonia was found to have no effect while  
 fumigation with SO<sub>2</sub> was found effective but with change in the  
 quality of the oil. Pilot plant studies were also conducted to  
 scale up the process.  
 Report(s) : Final.  
 Papers Published : 1. Ramaswamy, K.G. and others. Refining of rice bran oil. J.  
 Oil Technol. Assoc. India. 12(1); 1980; 16.  
 2. Sen, D.P. and others. Processing of rice bran and rice  
 bran oil for edible purposes. Presented at First Indian  
 Convention of Food Scientists and Technologists, Mysore,  
 June 1978.

\*258

1058 Project Title : Miscella refining of crude rice bran oil and recovery of  
 byproducts - wax, oryzanol and vitamin E rich germ oil.  
 Organisation : Central Food Technological Research Institute, Mysore 570013;  
 Lipid Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 1,71,000/-.  
 Duration : June 1980 - December 1982.  
 Sponsor(s) : CSIR  
 Investigator(s) : Sen, D.P. and others.  
 Description : Trials were conducted with several varieties of rice: raw,  
 roasted and parboiled rice. The local ghani press along with  
 addition of water and other materials was not successful in  
 extracting rice bran oil. However, a laboratory hydraulic  
 press was successfully used to press. approximately 40% of the  
 oil ( the oil content of the bran being 26%) in about 3 hours  
 time at 5000 psi. Experiments were also conducted to extract  
 the tocopherols using different solvents. It was indicated that  
 solvent extraction could be used for recovery of tocopherols.  
 Report(s) : Final.  
 Papers Published : 1. Ramaswamy, K.G. and others. Refining of rice bran oil. J.  
 Oil Technol. Assoc. India. 12(1); 1980; 15.  
 1059 Project Title : Preparaton of garlic oil and oleoresin.  
 Organisation : Central Food Technological Research Institute, Mysore 570013;  
 Plantation Products and Flavour Technology.  
 Project Category : Fundamental.  
 Cost : Rs. 70,000/-.  
 Duration : October 1980 - March 1981.  
 Sponsor(s) : Institute.  
 Investigator(s) : Shankaranarayana, M.L. and others.  
 Description : Laboratory method of Clevenger distillation of garlic gave  
 about 0.2% yield of oil. Few batches of large scale distillation  
 of oil were tried but the yields were comparatively less due to



the sticking of the oil in the condenser. Work is in progress to suitably modify the condenser.

Report(s) : -  
Papers Published : -

1060 Project Title : Biochemical studies on sunflower with reference to physical and chemical characteristics of oil and its keeping quality.  
Organisation : Tamil Nadu Agricultural University; Agricultural College and Research Institute, Coimbatore 641 003; Biochemistry Department.  
Project Category : Applied.  
Cost : Rs. 10,000/-.  
Duration : December 1978-November 1981.  
Sponsor(s) : University.  
Investigator(s) : Balasaraswathi, R.  
Description : The project is concerned with screening of the germ plasm for oil content and quality, determination of saturated and unsaturated fatty acids by computing I-value and thiocyanogen value, and studying the keeping quality of sunflower oil by estimating the free fatty acid content, peroxide value, etc.

Report(s) : -  
Papers Published : -

1061 Project Title : Preparation and use of food grade lecithin from soya sludge.  
Organisation : Central Food Technological Research Institute; Mysore 570013; Lipid Technology Discipline.  
Project Category : Applied.  
Cost : Rs. 2,25,200/-.  
Duration : August 1982 - August 1984  
Sponsor(s) : Institute.  
Investigator(s) : Prabhakar, J.V. and others.  
Description : Soya lecithin was prepared from soya sludge by using different solvents. Studies on removal of the acids from soya fines on a commercial scale were also carried out. Studies on raw groundnut oil showed that the native phosphatides had antioxidant activity at a high water activity. Refined and degummed groundnut oil with added groundnut oil phosphatides or soyalecithin were stored at different water activities at 40 C. The analysis of the oil at regular intervals indicated that groundnut oil phosphatides and soyalecithin had antioxidant properties in both refined and degummed groundnut oils as indicated by a slower development of peroxides in the treated samples compared to those without phosphatides addition.

Report(s) : -  
Papers Published : -

1062 Project Title : Preparation of speciality fats from new oils/fat for use in food industry.  
Organisation : Central Food Technological Research Institute, Mysore 570013.  
Project Category : Applied.  
Cost : Rs. 5,68,000/-.  
Duration : September 1980 - March 1983.  
Sponsor(s) : CSIR  
Investigator(s) : Prabhakar, J.V. and others.  
Description : The data on the availability of different minor oilseeds has been compiled and the total potential for the oil from these sources was estimated at about 2 million tonnes. During the period, solidification properties of Sal fat as affected by partial glycerides were studied. They affected super cooling property, crystallisation, solids content as well as crystallisation behaviour.

## Papers Published

1. Yella Reddy, S. and Prabhakar, J.V. Effect of oleic acid and glyceryl monostearate on the solidification properties of Sal fat. Presented at Ahara 82: International Food Conference, Bangalore, May 1982.
2. Yella Reddy, S. and Prabhakar, J.V. Effect of partial glycerides on the crystallisation behaviour of Sal fat. Presented at National Seminar on the Current Advances in the Technology of Oils and Allied Products, Kanpur, February 1982.

- 1963 Project Title : Study of water activity relationship to off-flavour development of lipid origin.
- Organisation : Central Food Technological Research Institute, Mysore 570013; Lipid Technology Discipline.
- Project Category : Applied.
- Cost : Rs. 6,72,000/-.
- Duration : May 1979 - May 1982.
- Sponsor(s) : CSIR
- Investigator(s) : Prabhakar, J.V.; Gopalakrishna, A.G.
- Description : Influence of water on the rate of autoxidation and formation of secondary products namely, carboxyl compounds, in methyl linoleate model system and other fats was studied. It was found that in addition to rate of oxidation, the quality of monocarbonyl compounds and the pattern of their formation also changed with water activity of the system. The peroxide decomposition and formation of carbonyls decreased with water activity. This was confirmed in studies on the effect of water activity on commercial groundnut oil. The water activity did not also have any influence on the formation of free fatty acids in groundnut oil. The studies also indicated that natural phosphatides in the virgin oil (raw) had a positive effect at high humidities as it stayed stable even at humidities higher than 67%.
- Report(s) : Final.
- Papers Published :
  1. Prabhakar, J.V. and Amla, B.L. Influence of water activity on the formation of monocarbonyl compounds in oxidising walnut oil. J. Food Sci. Technol. 43; 1978; 183.
  2. Gopalakrishna, A.G. and Prabhakar, J.V. Effect of water activity on autoxidation raw groundnut oil. Presented at National Seminar on the Current Advances in the Technology of Oils and Allied Products, Kanpur, February 1982.
  3. Gopalakrishna, A.G. and Prabhakar, J.V. Effect of water activity on autoxidation of methyl linoleate. Presented at Ahara 82: International Food Conference, Bangalore, May 1982.
  4. Verma, M.M. and Prabhakar, J.V. Effect of water activity on autoxidation of safflower seed oil. Indian Food Pack. 36(5); 1982; 77
- 1964 Project Title : Detection of adulteration of oils and fats and oil cakes.
- Organisation : Regional Research Laboratory, Hyderabad 500 009.
- Project Category : Applied.
- Cost : -
- Duration : April 1977 - March 1982.
- Sponsor(s) : Laboratory.
- Investigator(s) : Lakshminarayana, G.; Rao, K.V.S.A.
- \*782
- 1965 Project Title : Oxidative rancidity of oils. A correlative study of subjective and objective methods.
- Organisation : Central Food Technological Research Institute, Mysore 570013.
- Project Category : Fundamental and applied.



Cost : Rs. 2,16,550/-.  
 Duration : June 1969 - June 1981  
 Sponsor(s) : CSIR  
 Investigator(s) : Sen, D.P. and others.  
 Description : In groundnut oil stored at 37 C, 30 C and ambient temperature, the parameters, namely peroxide value (PV), anisidine value (AV) and diene value (DV) gradually rose at 37 C and 30 C. The increase was very limited at ambient temperature. In correlative studies, rancidity (by sensory evaluation) occurred at all the three temperatures almost simultaneously at 10 and 12 weeks of storage from odour and flavour points of view. In samples stored at ambient temperatures, rancidity was perceived at lower PV, AV and Kries value (KV) than in samples stored at 30 C and 37 C. Correlations with other chemical parameters with KV and TBA value were not very consistant. Results pointed out that the validity of the codex limit for PV of 10 as the limit of acceptability for all edible oils without reference to storage conditions, particularly temperature, has to be reexamined.

Report(s) : Final.  
 Papers Published : -

1066 Project Title : Preliminary screening of products of plant origin for their antioxidant efficacy to fats and oils during storage and heating.

Organisation : Central Food Technological Research Institute, Mysore 570013; Lipid Technology Discipline.

Project Category : Applied.

Cost : Rs. 36,900/-.

Duration : August 1981 - July 1982.

Sponsor(s) : Institute.

Investigator(s) : Armugham, C. and others.

Description : Thirty six plant materials (dehydrated and powdered) were tested for antioxidant property on stored refined groundnut oil of the materials tested, cabbage, gooseberry, onion, orange peel, mandarin peel, banana peel, tea powder and coffee powder showed strong antioxidant effect during storage at 60 C for 9 days. Cabbage showed the strongest antioxidant effect. The activity of the materials increased with heating (200 C) with the oil. Water extracts of cabbage powder, however, showed no antioxidant activity.

Report(s) : -  
 Papers Published : -

1067 Project Title : Nutritional and toxicological studies on oil from Cleome viscosa.

Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.

Project Category : Applied.

Cost : -

Duration : -

Sponsor(s) : ICAR

Investigator(s) : -

Description : Earlier it was shown that oil from seeds of C. viscosa was free from any unusual fatty acids, and linoleic acid accounted for nearly 75% of the total fatty acids. It was also shown that the oil was edible and was free from any toxicological effect when fed at 10% level in the diet. The present study is concerned with reproductive performance of rats fed this fat and confirms that C. viscosa oil is fit for consumption as a dietary source of fat.

Report(s) : -  
 Papers Published : -

Project Title	:	Detection of imported rapeseed oil in mustard oil.
Organisation	:	Central Aqmark Laboratory, Nagpur 440 010.
Project Category	:	Applied.
Cost	:	Rs. 3,000/-.
Duration	:	January 1981 - December 1981.
Sponsor(s)	:	Directorate of Marketing Inspection.
Investigator(s)	:	Grover, M.R.; Hussain, M.H.
Description	:	Adulteration of imported rapeseed oil in mustard oil is detected and a device is developed for checking the admixture of rapeseed oil in mustard oil.
Report(s)	:	-
Papers Published	:	-

  

1069 Project Title	:	Oil milling technology in Madhya Pradesh.
Organisation	:	Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal 460 010.
Project Category	:	Survey.
Cost	:	-
Duration	:	1979
Sponsor(s)	:	ICAR
Investigator(s)	:	Tarun Kapur.
Description	:	Five districts of M.P. were selected for the survey on the basis of quantum of oilseed production and concentration of the mills. It was found that expellers and solvent extraction are the two methods followed most. The capacity utilisation is as low as 49%. There is also a low degree of mechanisation in cleaning and material handling operation. The main problem experienced with an expeller is its gelling stuck after 250 hours of work due to high pressure and excessive heating. It is also seen that the bullock drawn ghanies and manual oil expellers (or Petula) are fast disappearing and the oil extraction industry is getting concentrated in urban areas.
Report(s)	:	Annual.
Papers Published	:	-

## 7. Microbiology

1070 Project Title	:	Surface microflora of stored seeds.
Organisation	:	B.P. Baria Science Institute, Navsari 396 445, Gujarat.
Project Category	:	Applied and Exploratory
Cost	:	Rs. 5,000/-.
Duration	:	October 1975 - 1983.
Sponsor(s)	:	College.
Investigator(s)	:	Desai, B.M. and others.
Description	:	The seed surface microflora have been surveyed and their effect on seed germination has been studied. Currently, work is in progress to identify the different bacterial flora and their interactions.
Report(s)	:	-
Papers Published	:	Desai, B.M. Germination of stored seeds and their surface mycoflora. J. South Gujarat. Univ. 8; 1979; 126-32

  

1071 Project Title	:	Morphological changes in freeze-dried lactic acid bacteria.
Organisation	:	National Dairy Research Institute, Karnal 132 001; Dairy Bacteriology Division.
Project Category	:	Applied.
Cost	:	-
Duration	:	1979-1981.
Sponsor(s)	:	ICAR



Investigator(s) : Prasad, D.N.; Sinha, R.N.  
 Description : Cells of freeze-dried *L. bulgaricus* and *L. casei* stored at 5 and 37 C and ambient temperatures. It was found that the larger cells of *L. bulgaricus* showed more structural damages as compared to smaller rods of *L. casei*. There was an indication of correlation between structural damage and viability of cells in both larger and smaller dimensions. Electron microscopic studies will also be conducted to determine damage to cells at finer levels. Similar studies will also be conducted on other lactic acid bacteria.  
 Report(s) : Annual report.  
 Papers Published : -

1072 Project Title : Studies on mutation in Lactic Streptococci with special reference to proteolytic activity.  
 Organisation : National Dairy Research Institute, Karnal 132 001. Dairy Bacteriology Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-1982  
 Sponsor(s) : ICAR  
 Investigator(s) : Suman Khanna; Srinivasan, R.A.  
 Description : *S. Lactis* C-10 and *S. cremoris* C-1 were grown at 10, 22, 30 and 37 C in milk and analysed for titratable acidity and tyrosine content. The titratable acidity rapidly increased with incubation temperature. Similarly, proteolytic activity also increased. When cultures were grown at 30 C for 21 days, the acidity increased upto 2 days after which it was constant whereas tyrosine content increased progressively. The cultures showed maximum acid and tyrosine in buffalo milk as compared to cow milk, goat milk and reconstituted milk. Survival curves after exposing the cultures for rays were plotted and mutants showing increased zones of proteolytic activity were isolated.  
 Report(s) : Annual report.  
 Papers Published : 1. Jasjit Singh and others. Effect of incubation temperature on acid production and proteolytic activity in milk by selected *Lactobacilli* mutants. *Folia Microb.* 25; 1980; 496.

1073 Project Title : Studies on antibacterial substance produced by *Streptococcus lactis* subsp. *diacetylactis*.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Reddy, N.S.; Ranganathan, B.  
 Description : The antibacterial substance was extracellular in nature; the intracellular cell free extract and the cell debris was free of antimicrobial activity. Of the 14 strains tested, the mutant strain 67/C produced maximum substance at pH 6.8. Above or below this pH growth and production of the antimicrobial substance was adversely affected. The optimum production was at 25 C and within 72 hours. The growth and product was adversely affected by agitation for varied periods. Maximum production was obtained at the inoculum level of 2%. Effects of various basal media on the growth and production of the antibacterial substance were also studied. The substance was a low molecular weight peptide exhibiting maximum antibacterial activity at pH 6.5.  
 Report(s) : -  
 Papers Published : -

- 1074 Project Title : Effect of some selected mutagenic agents on Dnase and toxin production in an enterotoxigenic *Staphylococcus aureus* S6.  
 Organisation : National Dairy Research Institute, Karnal 132 001; Dairy Bacteriology Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Ghodekar, D.R. and others.  
 Description : The toxigenic S6 strain capable of producing both thermonuclease and enterotoxins were exposed to UV radiation and the mutants were recovered on methyl green DNA agar medium. All the thermonuclease deficient mutants (20 nos) lost coagulase, enterotoxins and lecithinase production. This was reversible with visible light suggesting a coordinated mechanism for the synthesis and release of these metabolites. None of the mutants produced any fluid accumulation in rabbit ileal loops but gave a positive reaction in rabbit skin in two months. These characteristics were stable in the mutants for three months.  
 Report(s) : -  
 Papers Published : 1. Batish, V.K. and others. Production of thermonuclease deficient mutants from a toxigenic nuclease positive strain of *Staphylococcus aureus*. J. Food Sci. 46; 1981; 1252
- 1075 Project Title : Studies on heat injury to Coliform bacteria and their recovery in laboratory media.  
 Organisation : National Dairy Research Institute, Southern Regional Station, Audugodi, Bangalore.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Rama Raju, V.V.; Nambudripad, V.K.N.  
 Description : Release of cellular constituents from coliform isolates (*E. coli* B23 and *E. aerogenes* AE<sub>63</sub>) into the heating menstrum due to heat injury was studied. Work on the enumeration of injured cells of coliforms in dairy products by different plating techniques and utilisation of whey as an economic media was also carried out.  
 Report(s) : Annual.  
 Papers Published : -
- 1076 Project Title : Toxicity of microbial lipids.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Rattan Chand and others.  
 Description : A selected *Fusarium* strain producing 50 - 60% of lipid material in its cells was cultivated and lipid extracted by modified Deierkauf and Booijs' method. Phospholipids were also obtained from a known quantity of lipid. The lipid, being rich in unsaturated fatty acids, could not be studied for long even at low temperatures being highly susceptible to oxidation. The project was discontinued due to non-availability of certain chemicals.  
 Report(s) : -  
 Papers Published : 1. Rattan Chand and Srinivasan, R.A. Extraction and fractionation of lipids (polar and non-polar) from *Fusarium* sp. Indian J. Expt. Biol. 17; 1979; 66.



- 1077 Project Title : Studies on beta-galactosidase of fungal origin.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1979-1981  
 Sponsor(s) : ICAR  
 Investigator(s) : Agrawal, S.; Dutta, S.M.  
 Description : Conditions optimum production of enzymes from *Alternaria palmi* were worked out. The source of milk did not affect enzyme production. Similarly supplementation of whey with growth promoting substance like yeast extract, beef extract, milk extract, inorganic salts and phosphates also did not have any significant effect.  
 Report(s) : -  
 Papers Published : 1. Sanjeev Agarwal and others. Thermostable  $\beta$ -galactosidase from fungi. J. Dairy Sci. 65; 1982; 866.
- 1078 Project Title : Basic and developmental studies on the enzymes used in the processing of food materials.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Microbiology and Fermentation Technology Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 5,64,000/-.  
 Duration : January 1977 - March 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Sreenivasa Murthy, V. and others.  
 Description : The enzyme produced from *Rhizopus oligosporus*, on purification could be utilised for cheese making with good results.  $\alpha$ -amylase and amyloglucosidase from *Aspergillus niger* were produced and used for liquefying corn and tapioca starches. The kinetics of the enzymes were also worked out.  
 Report(s) : -  
 Papers Published : 1. Krishna Nand and others. Comparison of the yield and quality of cheese made with calf rennet and treated enzyme preparation of *Rhizopus oligosporus* as coagulants. Nahrung. 24(9); 1980; 859.  
 2. Krishna Nand and others. Effect of heat and alumina absorption on the protease of *Rhizopus oligosporus*. Indian J. Exp. Biol. 18(7); 1980; 761.  
 3. Nagaraja Rao, K.S. and others. Changes in the manufacture and ripening of cheddar cheese prepared with fungal rennet substitutes of *Rhizopus oligosporus*. Nahrung. 23(6); 1979; 621
- \*140
- 1079 Project Title : Changes in the profiles of intestinal microflora of laboratory animals and their influence on some physiological functions.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Microbiology and Fermentation Discipline.  
 Project Category : Applied.  
 Cost : Rs. 28,600/-  
 Duration : April 1979 - March 1980  
 Sponsor(s) : Institute.  
 Investigator(s) : Sreenivasa Murthy, V.  
 Description : Turmeric altered growth of intestinal bacteria in vitro by either inhibition or enhancement due to the presence of its active principle, curcumin. Alcoholic extract of turmeric was tried various organisms. While it suppressed *Staphylococci* and *B. cereus*, it had no effect on *Salmonella typhosa*. The pigment could suppress gas formation by *E. coli* and *C. perfringens* when fed to animals

it increased faecal bile acids levels. The antimicrobial activity of garlic was also studied and stable beyond 48 hrs. at room temperature. When fed to rats it altered intestinal flora and albumin-globulin ratio. Cooked garlic, however, enhanced growth of bacteria due to presence of peptide having 5-6 amino acids.

Report(s) : Final.

Papers Published : 1. Bhavanishankar, T.N. and Sreenivasa Murthy, V. Effect of turmeric (*Curcuma longa*) fractions on the growth of some intestinal and pathogenic bacteria in vitro. *Indian J. Exp. Biol.* 17(12); 1979; 1363  
2. Shashikanth, K.N. and others. Studies on the antimicrobial and stimulatory factors of garlic (*Allium sativum* Linn.). *J. Food Sci. Technol.* 18; 1981; 44.

1080 Project Title : Improvements in fermentation processes for economic production of ethanol.  
Organisation : Central Food Technological Research Institute, Mysore 570013; Discipline of Microbiology and Fermentation Technology.  
Project Category : Fundamental.  
Cost : Rs. 1,32,400/-.  
Duration : September 1981 - August 1982.  
Sponsor(s) : Institute.  
Investigator(s) : Basappa, S.C. and others.  
Description : Comparison of various fermentation techniques for alcohol production; studies on the improvement of viability of yeast cells<sup>s</sup> for continuous fermentation; mutation and selection of yeast strains that can tolerate high alcohol, high sugar and strains having high fermentation activity are some of the achievements of the project.

Report(s) : Final.

Papers Published : 1. Basappa, S.C. Immobilisation techniques in alcohol production. Presented at Colloquium on Enzyme Immobilisation, Mysore, April 1982.  
2. Basappa, S.C. Microbiological aspects on alcohol fermentation and fermentative techniques. Presented at Colloquium on Power Alcohol Production, Mysore, April 1982.  
3. Mohammed Kunhi, A.A. and others. Reduction of nucleic acid content in yeast cells by *Aspergillus candidus* R Nase treatment. Presented at Eighth International Specialised Symposium on Yeasts, Bombay, January 1983.

1081 Project Title : Studies on enterococci with special reference to their toxin production.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Applied.  
Cost : -  
Duration : 1972-  
Sponsor(s) : Institute.  
Investigator(s) : Batish, V.K.; Ranganathan, B.  
\*802

1082 Project Title : Studies on nisinase activity of bacteria.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Fundamental and applied.  
Cost : -  
Duration : 1973-  
Sponsor(s) : Institute.  
Investigator(s) : Sastry, K.J.; Mathur, D.K.  
\*803



- 1083 Project Title : Studies on genetic transformation in selected strains of lactic Streptococci.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Fundamental and Applied.  
 Cost : -  
 Duration : 1977-1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Sinhia, P.R.; Ranganathan, B.  
 \*807
- 1084 Project Title : Studies on the biosynthesis of phospholipids by Geotrichum candidum.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1975-  
 Sponsor(s) : Institute.  
 Investigator(s) : Rajendra Singh; Srinivasan, R.A.  
 \*810
- 1085 Project Title : Studies on fusarium toxicity.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : Earlier T-2 toxin, when fed to monkeys, was found to produce severe leucopenia, infection and death. Haematological and histological findings had indicated that action of the toxin may be by immunosuppression. Studies were therefore continued to elucidate the mechanism of action of T-2 toxin in monkeys. Result of these studies show that T-2 is a potent immunosuppressor. The suppression of immunity was parallel to the changes in total leucocyte count. This poor immunocompetence might have led to greater incidence of infection and death observed earlier in experimental monkeys. However, the immunosuppression appeared to be a transient phenomenon since the deleterious effects were reversed in 5 months when the toxin was withdrawn.  
 Annual Report  
 Report(s) : -  
 Papers Published : -
- 1086 Project Title : Production and characterisation of lipids and phospholipids of Fusarium sp.  
 Organisation : National Dairy Research Institute, Karnal 132 001; Dairy Bacteriology Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1980-  
 Sponsor(s) : ICAR  
 Investigator(s) : Rattan Chand; Srinivasan, R.A.  
 Description : Lipid from Fusarium sp. N-9 was separated into neutral lipids, glycolipids and phospholipids. The different fractions of phospholipids were obtained on DEAE cellulose column and the methyl esters of these fractions and neutral lipid were estimated gas chromatographically for fatty acids. The percentage of fatty acids were as follows: C<sub>16</sub>(18), C<sub>18</sub>(4.1), C<sub>18.1</sub>(37.8) and C<sub>18.0</sub>(9.1). Cholesterol level was higher than in other oils. Methyl esters of phosphatidyl choline and phosphatidyl ethano-

lamine were also prepared separately and the main fatty acids obtained from them by thin layer chromatography were oleic acid and linoleic acid. Currently, trials were underway to obtain non-pigmented lipid strains. The lipids will be compared with groundnut oil.

Report(s) : Annual Report.  
Papers Published : 1. Kattan Chand and Srinivasan, R.A. Extraction and fractionation of lipids (polar and non-polar) from *Fusarium* sp. Indian J. Exp. Biol. 17; 1979; 66.  
\*809

1087 Project Title : Factors controlling the production of haemolysin by *Vibrio parahaemolyticus*.  
Organisation : University of Agriculture Sciences; College of Fisheries, Mangalore 575 002.  
Project Category : Applied.  
Cost : Rs. 4,500/-.  
Duration : October 1979 - December 1981.  
Sponsor(s) : University.  
Investigator(s) : Kurunasagar, I.  
Description : The project aims to find out the environmental and nutritional factors controlling the production of haemolysin by *V. parahaemolyticus*. So far, haemolysin production has been studied in complex media when there are a number of nutritional variables. Hence, attempts were made to devise a chemically defined medium where the organisms are able to produce haemolysin. This has been successfully achieved.

Report(s) : -  
Papers Published : 1. Karunasagar, I. Production of haemolysin by *Vibrio parahaemolyticus* in a chemically defined medium. Appl. Environ. Microbiol. 41; 1981; 1274-5

1088 Project Title : Mycotoxicosis: Studies on toxins produced by common food contaminants belonging to *Aspergillus*, *Penicillium* and *Alternaria* sp.  
Organisation : University of Madras, Guindy Campus, Madras 600 025; Department of Biochemistry.  
Project Category : Fundamental and applied.  
Cost : -  
Duration : 1964 - continuing.  
Sponsor(s) : University.  
Investigator(s) : Shanmugasundaram, E.R.B.  
Description : The objectives of the project are to isolate common contaminating fungi from contaminated foods and feeds and to determine the biochemical effects. Currently, the toxins produced in common foods and their nature are being studied.

Report(s) : -  
Papers Published : -  
\*\*1048

1089 Project Title : Microbial production of gums from mollasses.  
Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani 431 402; Department of Food Science and Technology.  
Project Category : Applied.  
Cost : Rs. 2,00,000/-.  
Duration : June 1981-June 1984.  
Sponsor(s) : University and ICAR  
Investigator(s) : Pawar, R.E.; Ghonsikdar, C.P.  
Description : The project is concerned with isolation of *Azotobacter* species from soils of Marathwada region, and isolate and purify exopolysaccharides for use in the industrial production of micro-



bial gums from mollasses. The economics of the process will also be evaluated. The composition of the spent material will be studied for its efficacy as manure.

Report(s) : -  
Papers Published : -

## 8. AGRICULTURE

- 1090 Project Title : Study on utilisation of agricultural wastes for energy production.  
Organisation : Indian Institute of Technology, Kharagpur 721 302; Rice Process Engineering Centre.  
Project Category : Applied.  
Cost : Rs. 1,27,000/-.  
Duration : August 1977 - August 1980.  
Report(s) : Government of India, Department of Science and Technology.  
Investigator(s) : Maheshwari, R.C. and others.  
\*813
- 1091 Project Title : Saccharification of agricultural wastes.  
Organisation : Nagpur University; Laximinarayan Institute of Technology, Nagpur; Food Technology Section.  
Project Category : Applied.  
Cost : -  
Duration : 1975 onwards.  
Sponsor(s) : University.  
Investigator(s) : Rao, B.Y. and others.  
Description : Utilisation of jowar and tur stalks for the cultivation of *Trichoderma virideae* and their saccharification is being done. Studies have been carried out by solid culture method using *Trichoderma virideae*.  
Report(s) : -  
Papers Published : -
- 1092 Project Title : Utilisation of cellulosic waste through enzymatic degradation.  
Organisation : Marathwada Agricultural University; College of Agricultural Technology, Parbhani 431400; Department of Food Science and Technology.  
Project Category : Fundamental and applied.  
Cost : Rs. 7,00,000/-.  
Duration : October 1980-September 1985.  
Sponsor(s) : University and CSIR  
Investigator(s) : Kulkarni, D.N.; Jadhav, R.R.  
Description : Three crop residues, namely cotton stocks, sorghum stocks, and shells of legumes and oilseeds will be studied for chemical and biochemical conversion to useful chemicals. The project will cover three phases of work. During the first phase, data will be collected for availability and processing of the above raw materials, and they will be analysed for composition and crystalline nature of native cellulose. During the second phase, the raw materials will be subjected to various mechanical and chemical treatments to increase their susceptibility towards enzymatic degradation.  
Report(s) : -  
Papers Published : -
- 1093 Project Title : Analysis of weather data for drying and storage studies.  
Organisation : Punjab Rao Krishi Vidyapeeth, Akola-444 104; Harvest and Post-harvest Technology Scheme  
Project Category : Applied.  
Cost : Rs. 40,000/-.

- Duration : 1980-1983.  
 Sponsor(s) : Indian Council of Agricultural Research and Maharashtra Government.  
 Investigator(s) : Korde, P.D.; Paturde, J.T.  
 Description : The data often year on weather is collected and being analysed to correlate with drying and storage studies.  
 Report(s) : -  
 Papers Published : -
- 1094 Project Title : Sugarcane breeding for high yield and high sucrose by multiple crosses.  
 Organisation : Sugarcane breeding Institute, Coimbatore 641 007; Genetics and cytogenetics Division.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977-  
 Sponsor(s) : Institute.  
 Investigator(s) : Kandaswami, P.K.; Sreenivasan, T.V.  
 \*815
- 1095 Project Title : Breeding of amaranths for protein - rich grains and carotene-rich pot herbs.  
 Organisation : National Botanic Gardens, 1, Rana Pratap Marg, Lucknow 226001.  
 Project Category : Fundamental.  
 Cost : -  
 Duration : January 1970 - December 1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Mohinder Pal; Raghov Ram.  
 \*816
- 1096 Project Title : Integrated Oilseeds Research Scheme.  
 Organisation : Gujarat Agricultural University; Junagadh Campus; College of Agriculture, Junagadh 362 001.  
 Project Category : Applied.  
 Cost : Rs. 3,75,793/-.  
 Duration : 1962-  
 Sponsor(s) : University.  
 Investigator(s) : Patel, P.K. and others.  
 \*832
- 1097 Project Title : All India coordinated Research Project on soybean.  
 Organisation : Gujarat Agricultural University, Junagadh Campus; College of Agriculture, Junagadh 362 001.  
 Project Category : Applied.  
 Cost : Rs. 15,610/-.  
 Duration : 1970-  
 Sponsor(s) : University; and Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Singh, B.B.  
 \*833
- 1098 Project Title : All India Coordinated Research Project on oilseeds: Groundnut.  
 Organisation : Gujarat Agricultural University, Junagadh Campus; College of Agriculture, Junagadh 362 001.  
 Project Category : Applied.  
 Cost : Rs. 2,63,233/-.  
 Duration : 1968-  
 Sponsor(s) : University; and Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Reddy, M.V. and others.  
 \*834



- 1099 Project Title : Breeding sunflower for higher oil yield.  
 Organisation : National Botanic Gardens, 1, Rana Pratap Marg, Lucknow  
 226 001.  
 Project Category : Fundamental.  
 Cost : -  
 Duration : January 1968 - December 1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Khanna, K.R. and others.  
 \*835
- 1100 Project Title : Bioregulation of plant composition by use of plant growth  
 r gulators (like auxin, gibberellins, autokinins, herbici-  
 des, etc.)  
 Organisation : Mahatma Phule Agricultural University, Rahuri, Dist. Ahmed-  
 nagar, Maharashtra; Department of Food Science and Technology.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 50,000/-.  
 Duration : June 1981 - June 1984.  
 Sponsor(s) : Government of Maharashtra and ICAR  
 Investigator(s) : Desai, B.B. and others.  
 Description : The project has been initiated to improve the chemical compo-  
 sition and quality parameters of fruits and vegetables like  
 tomato and brinjal (e.g. colour, vitamins, lycopene, protein,  
 glycoalkaloid, etc.)  
 Report(s) : -  
 Papers Published : -
- 1101 Project Title : Engineering properties of selected agricultural products.  
 Organisation : Punjab Agricultural University, Ludhiana 141 004; College  
 of Agricultural Engineering, Department of Processing and  
 Agricultural Structures.  
 Project Category: : Applied.  
 Cost : Rs. 53,995/- per annum.  
 Duration : 1969 onwards.  
 Sponsor(s) : Punjab Government.  
 Investigator(s) : Kashyap, M.M.; Sadhna Arora.  
 Description : The project aims to study the physical, aerodynamic, mechanical  
 and physiological characteristics of plant material from seeds  
 through different stages of growth.  
 Report(s) : -  
 Papers Published : -  
 \*\*229
- 1102 Project Title : Engineering studies for utilization of agricultural by-  
 products.  
 Organisation : Punjab Agricultural University, Ludhiana 141 001; College of  
 Agricultural Engineering; Department of Processing and Agri-  
 cultural Structures.  
 Project Category : Applied.  
 Cost : Rs.0.80 lakhs per annum.  
 Duration : 1974 onwards.  
 Sponsor(s) : Punjab Government.  
 Investigator(s) : Kashyap, M.M.; Amar Singh.  
 Description : The problems associated with the mechanical handling techni-  
 ques for existing utilization of agricultural by products have  
 been quantified and the engineering properties of each by-  
 products for further processing are being studied.  
 Report(s) : -  
 Papers Published : -  
 \*\*229

- 1103 Project Title : Production of grapes for table and juice processing in Gangetic plains.  
 Organisation : National Botanic Gardens, 1, Rana Pratap Marg, Lucknow 226 001.  
 Project Category : Fundamental and applied.  
 Cost : -  
 Duration : January 1974 - June 1980  
 Sponsor(s) : Institute.  
 Investigator(s) : Khanduja, S.D. and others.  
 \*817
- 1104 Project Title : All India Coordinated Research Programme on Post-harvest Technology.  
 Organisation : Himachal Pradesh Krishi Vishwa Vidyalaya, College of Agriculture, Solan 173 223; Department of Pomology and Fruit Technology.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 50,00,000/-.  
 Duration : August 1978 - July 1983.  
 Sponsor(s) : ICAR/FERRO (US Dept. of Agric.)  
 Investigator(s) : Manoranjan Kalia; Sharma, T.R.  
 Description : The project covers research and development, teaching undergraduate and post-graduate programmes and holding extension education courses on post-harvest technology of crops. Establishment of laboratories and pilot plants are also envisaged.  
 Report(s) : -  
 Papers Published : -
- 1105 Project Title : To study the effect of nitrogen and phosphorous levels on maturity, yield and quality of bajra.  
 Project Category : University of Udaipur; Colleges of Technology and Agricultural Engineering, Udaipur 313 001; Harvest and Post Harvest Technology Scheme.  
 Cost : Applied.  
 Duration : 1973-  
 Sponsor(s) : University; and Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Joshi, V.  
 \*825
- 1106 Project Title : Effect of yield and quality of maize varieties when sown at different dates and harvested at different grain moisture content.  
 Organisation : University of Udaipur; College of Technology and Agricultural Engineering, Udaipur 313 001; Harvest and Post Harvest Technology Scheme.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1973-  
 Sponsor(s) : University; and Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Joshi, V.  
 \*827
- 1107 Project Title : The effect on yield and quality of maize varieties when harvested at different levels of moisture content of grains.  
 Organisation : University of Udaipur; College of Technology and Agricultural Engineering, Udaipur 313 001; Harvest and Post Harvest Technology Scheme.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1973-



Sponsor(s) : University and Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Joshi, V.  
 \*828

1108 Project Title : The study of the effect of mulches on yield and moisture content of maize grain under rain fed conditions.  
 Organisation : University of Udaipur; College of Technology and Agricultural Engineering, Udaipur 313 001; Harvest and Post Harvest Technology Scheme  
 Project Category : Applied.  
 Cost : -  
 Duration : 1973-  
 Sponsor(s) : University and Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Joshi, V.  
 \*829

## ANIMAL HUSBANDRY

### Cattle

1109 Project Title : Effect of plane of nutrition on the utilisation of feed nutrients for milk production in buffaloes.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1972-  
 Sponsor(s) : Institute.  
 Investigator(s) : Kurar, C.K.; Mudgal, V.D.  
 \*845

1110 Project Title : Utilisation of plasma amino acids for synthesis of milk proteins with particular reference to arginine by buffalo mammary glands.  
 Organisation : National Dairy Research Institute, Karnal 132 001  
 Project Category : Applied.  
 Cost : -  
 Duration : 1973-  
 Sponsor(s) : Institute.  
 Investigator(s) : Ajit Singh; Tomer, O.S.  
 \*846

1111 Project Title : Incidence of Mastitis infections involving gram negative organisms.  
 Organisation : National Dairy Research Institute, Southern Regional Station, Audugodi, Bangalore.  
 Project Category : Amtilo and survey.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICAR  
 Investigator(s) : Rao, K.R.S.; and others.  
 Description : Of about 170 samples screened, 15 were found infected out of which 11 were subclinical cases and 4 were clinical cases. The causative organisms were coliforms in 4 samples, Klebsiella in one sample, Streptococci in 7 samples and Staphylococci in 3 samples. The gram negative organisms were identified as E. coli and Klebsiella. The serum protein and amino acid patterns of infected milks were also determined.  
 Report(s) : Annual Report.

- Papers Published : 1. Rao, K.R.S and Anantharamaiah, S.N. Mastitis in milking cows: contributory factors. Mikow, 4(4); 1982; 15.  
2. Rao, K.R.S. and Anantharamaiah, S.N. Studies on incidence of mastitis by means of survey of farm animals and control measures. Livestock Advisor, 7; 1982; 37.

1112 Project Title : Studies on milk fat and SNF production in cattle at NDRI.  
Organisation : National Dairy Research Institute, Karnal 132 001.  
Project Category : Survey  
Cost : -  
Duration : 1981-82  
Sponsor(s) : Indian Council of Agricultural Research.  
Investigator(s) : Sharma, K.N.S. and others.  
Description : The total production of fat and SNF in a lactation has been estimated and the variation in fat and SNF due to breeds, season of calving, parity etc, have been studied.  
Report(s) : Annual Report.  
Papers Published : Nil.

### Sheep and Goat

- 1113 Project Title : Studies on the growth parameters and meat potentialities of (Bannur X Deccani) crossbred sheep under different feeding systems.  
Organisation : Marathwada Agricultural University; College of Veterinary and Animal Sciences, Parbhani 431 402.  
Project Category : Applied and Exploratory.  
Cost : Rs. 50,000/-.  
Duration : January 1978 - December 1980.  
Sponsor(s) : University  
Investigator(s) : Gaffar, M.A. and others.  
\*847
- 1114 Project Title : All India Coordinated Research Project on goat.  
Organisation : Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra.  
Project Category : Applied.  
Cost : Rs. 70,00,000/-.  
Duration : July 1971 - March 1980  
Sponsor(s) : Indian Council of Agricultural Research, New Delhi; and Government of Maharashtra.  
Investigator(s) : Chavan, I.G. and others.  
\*848
- 1115 Project Title : All India Co-ordinated Research Project on goats.  
Organisation : Assam Agricultural University, Gauhati 785 022.  
Project Category : Applied.  
Cost : 4,06,894/- per year  
Duration : January 1973-  
Sponsor(s) : Indian Council of Agricultural Research, New Delhi; and Government of Assam.  
Investigator(s) : Baishya, N. and others.  
\*849
- 1116 Project Title : Breeding goats for meat.  
Organisation : Orissa University of Agriculture and Technology, Bhubaneswar 751 003.  
Project Category : Applied and Exploratory.  
Cost : Rs. 80,000/-,  
Duration : 1971-  
Sponsor(s) : University  
Investigator(s) : -  
\*850



## Pig

- 1117 Project Title : All India Co-ordinated Research Projects on pigs.  
 Organisation : Andhra Pradesh Agricultural University; College of Veterinary Science, Tirupati 517 502  
 Project Category : Applied  
 Cost : -  
 Duration : March 1971 - March 1979  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi; and University  
 Investigator(s) : Raina, B.L. and others.  
 \*852
- 1118 Project Title : All India Coordinated Research Project on pigs.  
 Organisation : Assam Agricultural University, Gauhati 785 002.  
 Project Category : Applied.  
 Cost : Rs. 10,50,000/-  
 Duration : October 1970 - 1979.  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi.  
 Investigator(s) : Bhatia, S.S. and others  
 \*853

## Poultry

- 1119 Project Title : All India Coordinated Research Project on Poultry Breeding for meat.  
 Organisation : Orissa University of Agriculture and Technology, Bhubaneswar 751 003  
 Project Category : Exploratory  
 Cost : Rs. 2,50,000/- per annum.  
 Duration : March 1971 - March 1979  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi; and University.  
 Investigator(s) : Pani, S.N. and others.  
 \*855
- 1120 Project Title : All India Coordinated Research Project on poultry for meat.  
 Organisation : Tamil Nadu Agricultural University; Poultry Research Station, Teynampet, Madras 600 018; Poultry Science Department.  
 Project Category : Applied.  
 Cost : Rs. 5,00,000/- per year  
 Duration : May 1971 - March 1979  
 Sponsor(s) : Indian Council of Agricultural Research, New Delhi 110 001.  
 Investigator(s) : Ulaganathan, V.  
 \*861
- 1121 Project Title : Influence of strain, age, sex, type of housing and stocking densities on broiler carcass traits.  
 Organisation : Tamil Nadu Agricultural University; Veterinary College, Madras; Department of Poultry Science.  
 Project Category : Applied.  
 Cost : Rs. 15,000/-.  
 Duration : 1981-1983  
 Sponsor(s) : University.  
 Investigator(s) : Sheriff, F.R.  
 Description : The influence of breed and strain among broiler breeds on meat yields and composition and the effect of age and sex on the nutritive characteristics of broiler chicken are being studied. The influence of type of housing in meat quality and dressing percentages; the influence of stocking densities on meat yields, composition and performance of broilers; the effect of age, sex, strain, stocking densities and housing on the yields

of carcass fat and the influence of age and sex on the yields of blood, feather, offals, head and shank in pure and strain crosses are also being investigated.

Report(s)  
Papers Published

1122 Project Title : Multigeneration studies on the effect on petroleum yeast on reproduction, histopathology and toxicity of layer chicken.  
Organisation : Central Food Technological Research Institute, Mysore 570013; Meat, Fish and Poultry Technology Discipline.  
Project Category : Fundamental and Applied.  
Cost : Rs. 46,630/-.  
Duration : May 1978-April 1980.  
Sponsor(s) : Institute.  
Investigator(s) : Haleem, M.A.; Jagannatha Rao, R.  
Description : Birds were fed with control diet (a), 10% petroleum yeast, (b) and 20% petroleum yeast (c). In the hatchability and fertility tests, no adverse effect were noticed on account of petroleum yeast.  
Report(s) : Final.  
Papers Published : -  
\*859

1123 Project Title : Evolving a superior strain and hybrid white leghorn for egg production.  
Organisation : Tamil Nadu Agricultural University; Poultry Research Station, Nandanam, Madras 600 035; Poultry Science Department.  
Project Category : Applied.  
Cost : Rs. 5,00,000/- per year.  
Duration : January 1971 -  
Sponsor(s) : University.  
Investigator(s) : Jayaprasad, I.A.  
\*862

## 10. MEDICINE (Nutrition, Metabolism, Toxicology)

### Nutrition and Metabolism

1124 Project Title : Enzyme inhibitors of plant origin and their action on human GI enzymes.  
Organisation : Kasturba Medical College, Manipal 576 119; Department of Biochemistry.  
Project Category : Exploratory.  
Cost : Rs. 1,20,000/-  
Duration : 1979-1984  
Sponsor(s) : Indian Council of Agricultural Research.  
Investigator(s) : Pattabhiraman, T.N. and others.  
Description : Protease and amylase inhibitor levels in plant seeds of Indian red wood, pearl millet, finger millet red gram etc. have been identified. A trypsin/chymotrypsin inhibitor that can act powerfully both on human and enzymes has been isolated and characterized from the seeds of Indian red wood. This seed has shown to have the highest inhibitory activity among the legumes. Two protease inhibitors have been isolated from pearl millet and their properties have been analysed. A trypsin/amylase inhibitor and a trypsin/chymotrypsin inhibitor have been isolated from finger millet.



- Report(s) : Four project reports.
- Papers Published : 1. Chandrasekhar, G. and others. Natural plant enzyme inhibitors:  $\alpha$ -amylase inhibitors in millets. J. Sci. Food Agric. 32, 1981; 9
2. Chandrasekhar, G. and Others. Natural plant enzyme inhibitors: protease inhibitors in millets. J. Sci. Food Agric. 33; 1982; 447
3. Prabhu, K.S. and Pattabhiraman, T.N. Natural plant enzyme inhibitors: Isolation and characterization of a trypsin/chymotrypsin inhibitor from Indian red wood seeds. J. Sci. Food Agric. 31; 1980; 967
4. Chandrasekhar, G. and Pattabhiraman, T.N. Natural Plant enzyme inhibitors: Isolation and characterization of two trypsin inhibitors from Bajra. Indian J. Biochem. Biophys. 19(1); 1982; 1
- 1125 Project Title : Studies on PUFA and hypertension.
- Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.
- Project Category : Fundamental.
- Cost : -
- Duration : -
- Sponsor(s) : ICMR
- Investigator(s) : -
- Description : Earlier it was reported that administration of safflower oil in addition to drug therapy was effective in control of hypertension with patients who did not adequately respond to drugs alone. The studies were therefore extended to determine whether the oils rich in PUFA alone could lower blood pressure. Experiments with 24 essential hypertension patients who were assigned by rotation to either the control group (receiving 100 mg starch in gelatin capsules) or one of the two therapeutic groups (receiving 20 ml of groundnut oil or safflower oil per day). The average age of the patients was  $46.7 \pm 1.9$  years; there were 13 males and 11 females. Recordings of resting, supine blood pressure were made 10 minutes apart every work for 3 weeks after which similar weekly records were made to obtain post treatment values. Results showed that both groundnut oil and safflower oil significantly reduced diastolic blood pressure but not systolic pressure.
- Report(s) : Annual.
- Papers Published : -
- 1126 Project Title : Nutritional profile of tribal groups.
- Organisation : Kerala Agricultural University; College of Agriculture, Vellayani, Trivandrum - 695 522; Department of Agricultural Extension, Food Science and Nutrition Section.
- Project Category : Survey
- Cost : Rs. 1,000/-
- Duration : 1980-1983.
- Sponsor(s) : University
- Investigator(s) : Vimalakumari, N.; Prema, L.
- Description : The common dietary habits of specific tribal groups and the effect of food production and procurement on their nutritional status are investigated.
- Report(s) : -
- Papers Published : -
- 1127 Project Title : Baseline survey in the Integrated Tribal Development Agency, East Godavari, Rampachodavaram.
- Organisation : Andhra Pradesh Agricultural University, College of Home Science, Saifabad, Hyderabad 500 004.

- Project Category : Survey.  
 Cost : Rs. 32,000/-.  
 Duration : August 1981 - January 1982.  
 Sponsor(s) : UNICEF  
 Investigator(s) : Pushpamma, P. and others.  
 Description : The project has been initiated with the following objectives:  
 (i) to study the mortality and morbidity ratio of tribals in general and preschool children in particular (ii) to assess their nutritional status with special emphasis on vulnerable groups (iii) to survey of environmental and sanitation of households and (iv) to assess the training needs of various personnel involved in implementation of tribal developmental activities.
- Report(s) : -  
 Papers Published : -
- 1128 Project Title : Nutritional Supplements and diet foods  
 Organisation : Sandoz (India) Limited, Dr. Annie Besant Road, Bombay 400 018  
 Project Category : Applied.  
 Cost : -  
 Duration : Ongoing.  
 Sponsor(s) : Company  
 Investigator(s) : Savagoan, K.A. and others.  
 Description : The project aims at development of acceptable food supplements for meeting supplementary, special and total needs of different population groups in consonance with current knowledge of food and nutrition.
- Report(s) : -  
 Papers Published : -
- 1129 Project Title : Nutritional and toxicological studies with petroleum yeast on animals and poultry.  
 Organisation : Central Food Technological Research Institute, Mysore 570 013; Biochemistry and Applied Nutrition Discipline.  
 Project Category : Applied.  
 Cost : Rs. 5,67,550/-  
 Duration : April 1982 - Sept. 1984  
 Sponsor(s) : Institute.  
 Investigator(s) : Venkat Rao, S. and others.  
 Description : Screening tests with rats and broilers will be conducted on the two samples of petroleum yeast (one as such and the other washed to remove toxic components if any) involving a study of growth rate blood composition and histopathology of organs, before commencement of long term trials on animals.
- Report(s) : -  
 Papers Published : -
- 1130 Project Title : Erythrocyte membrane in rape seed and mustard oil fed rats osmotic fragility, lipid composition and ATPases.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500007.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : Resistance to osmotic fragility of erythrocyte membrane was observed in rats fed the above oils. The resistance in female rats was much less but only with mustard oil. The increase in resistance was attributed to the increased cholesterol phospholipid molar ratio, but it was considered



necessary to study the fatty acid composition of the erythrocyte membrane particularly the double bond index. The result of these investigations also revealed altered lipid composition of plasma membrane, but this was not statistically significant. The increased Oubain  $\text{Na}^+$ ,  $\text{K}^+$  ATPase in the erythrocyte membrane of mustard oil fed rats was considered to possibly mean an alteration in the enzyme activity per se and it might reflect increased Oubain binding to the enzyme molecule due to modified lipid microenvironment of the plasma membrane. Further studies on the fatty acid composition of erythrocyte membrane in rats fed groundnut, rapeseed and mustard oils are in progress.

Report(s) : Annual  
Papers Published : -

1131 Project Title : Effect of prolonged feeding of irradiated wheat on ageing in rats.  
Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.  
Project Category : -  
Cost : -  
Duration : -  
Sponsor(s) : ICMR  
Investigator(s) : -  
Description : Earlier it was shown that feeding of freshly irradiated wheat to rats was associated with increased polyploidy and impaired immune response. These adverse effects were, however, not seen with irradiated wheat stored for 12 weeks or more. There was also preliminary indication of lowering of labile collagen content of skin of rats fed freshly irradiated wheat for a period of 2 years, suggesting an accelerated ageing process. This study was initiated to find out if this is really so. Results of the study with rats indicated that continuous feeding of freshly irradiated wheat has no influence on the ageing process.  
Report(s) : Annual.  
Papers Published : -

1132 Project Title : Sister chromatid exchanges (SCEs) in experimental animals fed irradiated wheat.  
Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.  
Project Category : Fund.  
Cost : -  
Duration : -  
Sponsor(s) : ICMR  
Investigator(s) : -  
Description : Analysis of SCE and induction of DNA repair are considered sensitive methods for mutagenicity. The effect of feeding irradiated wheat on these parameters were therefore studied in two species of animals, monkeys and mice. Results showed that animals fed irradiated wheats showed a higher incidence of polyploid cells, but the study did not reveal any mutagenic effect attributable to irradiated wheat.  
Report(s) : Annual.  
Papers Published : -

1133 Project Title : Effect of dietary vitamin A and protein deficiencies on cellular retinol binding protein levels in rat tissues.  
Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.  
Project Category : Fundamental.  
Cost : -

- Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : It was reported earlier that cellular retinol binding protein (CRPB) is present in several human and animal tissues. This protein is distinctly different from serum retinol binding protein. The tissues in which CRPB is present is required and the protein is believed to be concerned with the mediation of vitamin A action. These studies were carried out to determine the effect of dietary depletions of vitamin A and protein on CRPB levels in liver, kidney and the eye. The experiments with 40 weaning rats show that the CRPB mediated actions of vitamin A are likely to be affected by protein deficiency in the organs with liver and kidney. Physiological implications of these data need further study.
- Report(s) : Annual.  
 Papers Published : -
- 1134 Project Title : Radiolysis of vitamin A and beta-carotene.  
 Organisation : Bhabha Atomic Research Centre, Bombay,  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre  
 Investigator(s) : Brij Bhushan and others.  
 Description : Fat soluble vitamin A,  $\beta$ -carotene and ubiquinone-30 were not sensitive to radiation damage in colloidal dispersions. However, in fully dissolved state, they were susceptible. The G value representing the number of molecules destroyed per 100 i.v. of absorbed dose was 2.5 for  $\beta$ -carotene, 1.3 for vitamin A alcohol and 0.28 for vitamin A acetate. In vitamin A, gamma irradiation brought about hydroxylation in the molecule accompanied by a marked loss in the conjugated double bonds. In  $\beta$ -carotene, however, it induced extensive deconjugation. The significance of the action of radiation degradation products (RDP) in the preservation of irradiated foods was also investigated particularly the enzyme mediated spoilage. Irradiated beta carotene or the RDP isolated from it produced instantaneous release of marker enzymes from intact lysosomes suggesting these were potent membrane labilisers. However, the efficiency of beta carotene RPD in rendering lysosomal fragility was inferior to that of vitamin A alcohol or its RDP.
- Report(s) : -  
 Papers Published : 1. Brij Bhushan and Kumta, Umesh, S. Radiation response of vitamin A in aqueous dispersion. J. Agric. Food Chem. 25, 131-135, 1977.  
 2. Ninjoor, V., Brij Bhushan and Nadkarni, G.B. Labilizing effects of radiolytic products of  $\beta$ -carotene and vitamin A on liver lysosomes in vitro. Wld, Rev. Nutr. Diet., vol.31, pp.119-124, 1978.
- 1135 Project Title : Influence of food constituents on radiation induced protein aggregation in food model systems  
 Organisation : Bhabha Atomic Research Centre, Bpombay.  
 Project Category : Applied.  
 Cost : -  
 Duration : -  
 Sponsor(s) : Centre.  
 Investigator(s) : Paul, P.



- Description : Effects of  $\gamma$ -irradiation on protein aggregation using model systems approximating the composition of meat are being studied. Lamb meat is used as a source to obtain meat proteins to incorporate in the model system. Studies on the influence of saturated and unsaturated lipids and vitamin E on radiation induced protein aggregation are also being carried out.
- Report(s) : -
- Papers Published : -
- 1136 Project Title : Trace element content of breast milk.
- Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.
- Project Category : Fundamental and applied.
- Cost : -
- Duration : -
- Sponsor(s) : ICMR
- Investigator(s) : -
- Description : Milk samples from low income women in various lactating periods were collected and analysed for Cr, Cu, Mn and Mo by atomic absorption spectrophotometry. Wide variations existed between individuals in trace element content. The mean levels of all trace elements were higher in colostrum. The fall in mean level between colostrum and transitional and mature milk was very steep with Co, significant with Cr and Mo and not significant with Mn. No significant differences in the contents of these minerals in mature milk with increasing duration of lactation were observed. Comparison of present data with those reported for developed countries showed Co content was similar while Mn and Cr content were lower by 25%. But no informations on Mo content was available.
- Report(s) : Annual
- Papers Published : -
- 1137 Project Title : Niacin content of breast milk.
- Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 570 007.
- Project Category : Fund and Survey
- Cost : -
- Duration : -
- Sponsor(s) : ICMR
- Investigator(s) : -
- Description : Milk samples from mothers in different stages of lactation for niacin and belonging to either high or low socio-economic groups were assayed by microbiological technique using *L. arabinosus*. The niacin content was found to be higher in transitional milk than in colostrum in both groups. The niacin content of mature milk was essentially similar to that of transitional milk. The mature milk of mothers of low socio-economic groups contained lower niacin content than in mothers of high socio-economic groups.
- Report(s) : Annual
- Papers Published : -
- 1138 Project Title : Dietary intake of pregnant women from low income group.
- Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.
- Project Category : Survey.
- Cost : -
- Duration : -
- Sponsor(s) : ICMR
- Investigator(s) : -
- Description : This diet survey has indicated that inspite of changes in socio-economic, educational and health care during the last

20 years, dietary intake and nutritional status of pregnant women have not shown any significant change.

Report(s) : Annual.

Papers Published : -

1139 Project Title : Dietary intake in lactating women from low income group.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.  
 Project Category : Survey.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : Data was collected on lactating women from two outpatient departments, i.e. pediatric and immunisation clinics. Significant differences were apparent in haemoglobin status of these women. Data on dietary intake and body weight were therefore obtained on them which show that the women attending the immunisation clinic were better nourished though no differences were observed in non-lactating women of low income group (attending the General OPD).

Report(s) : Annual.

Papers Published : -

1140 Project Title : Use of weaning foods by rural communities.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.  
 Project Category : Survey.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : Among poor rural community there is delayed weaning and additional foods are not given to infants until almost the end of first year of life. It has also been shown that the habitual diet of preschool children provide adequate levels of energy. Several recipes from locally available foods which have been developed satisfactorily are not being used by rural communities to a significant extent. This is attributed to lack of awareness as well as socio-economic status. The present studies have indicated that overriding factor for delayed introduction of supplementary foods to older infants and young children is low purchasing power.

Report(s) : Annual.

Paper Published : -

1141 Project Title : Energy intake of well-to-do preschool children.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.  
 Project category : Fund and Survey.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : Preschool children (150) between 2 and 5 years of age from fairly well to do families - and living in good hygienic environment with good medical care, immunisation and protected water supply were selected for this study. Anthropometric measurements, and food intake data were obtained every alternate month for 12 months. Preliminary statistical analysis of data showed that energy intakes of the children of upper income group growing normally, are similar to recommended daily allowance (RDA) and intake of most other nutrients are above RDA. A similar study of rural children fed the same levels



of nutrients grew equally well inspite of the poor environment, inadequate medical care and frequent infections.

Report(s) : Annual.  
Papers Published : -

1142 Project Title : Lactose and milk intolerance.  
Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.  
Project Category : Fund and survey.  
Cost : -  
Duration : -  
Sponsor(s) : ICMR  
Investigator(s) : -  
Description : Four hundred and ten apparently normal subjects from all age groups from urban areas were studied for lactose and milk intolerance by feeding and clinical tests. Results indicated that milk intolerance was low in all age groups with no significant differences between whole milk and skim milk. Lactose intolerance symptoms developed in a large proportion of subject after standard dose (2 g/kg). Its prevalence showed a progressive increase with age from 1.2% in preschool children to 50% in adults. Forty six percent of those having lactose malabsorption had no symptoms of lactose intolerance indicating that there was no association between lactose intolerance and milk drinking habits.

Report(s) : Annual.  
Papers Published : -

1143 Project Title : Diet and nutrition surveys.  
Organisation : Government of India; Ministry of Agriculture and Irrigation; Krishi Bhavan, New Delhi 110 001; Department of Food; Food and Nutrition Board.  
Project Category : Survey.  
Cost : Rs. 2,64,000 per annum.  
Duration : 1978-  
Sponsor(s) : Food and Nutrition Board.  
Investigator(s) : Banerjee, S.N.  
\*871

1144 Project Title : A study on the applied nutrition programme implemented in Kerala State.  
Organisation : Kerala Agricultural University; College of Agriculture, Vellayani, Trivandrum 695 522; Department of Agricultural Extension, Food Science and Nutrition Section.  
Project Category : Survey.  
Cost : Rs. 1,000/-  
Duration : 1978-1982.  
Sponsor(s) : University  
Investigator(s) : Menon, A.G.G., and others.  
\*872

1145 Project Title : Education in Foods and Nutrition in Agricultural Universities (EFNAG) project.  
Organisation : Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur 482 004; Faculty of Agriculture; Department of Food Science.  
Project Category : -  
Cost : Rs.1,24,000/- per year.  
Duration : January 1981-December 1986  
Sponsor(s) : ICAR and UNICEF  
Investigator(s) : Gupta, A.K. and others.

- Description : The objective is to introduce a compulsory course in foods and nutrition in B.Sc. (Agric.) curricula. The department envisages to hold a national conference on tribal nutrition and foods during 1982.
- Report(s) : -
- Papers Published : -
- 1146 Project Title : Related effectiveness of selected extension methods in imparting knowledge on food and nutrition among rural and urban beneficiaries of nutrition programme.
- Organisation : Kerala Agricultural University; College of Agriculture, Vellayani, Trivandrum 695522; Department of Agricultural Extension, Food Science and Nutrition Section.
- Project Category : Exploratory
- Cost : Rs. 3,000/-
- Duration : 1978-1981
- Sponsor(s) : University.
- Investigator(s) : Menon, A.G.G. and others.
- Description : The most effective combination of selected extension methods for imparting knowledge to the beneficiaries on nutrition programme are determined and the association between the socio-personal characteristics of the participants and their response to the extension methods are assessed.
- Report(s) : -
- Papers Published : 1. Menon (AGG) and others. Effectiveness of extension methods in nutrition education programmes. Indian J. Home Sci. (under publication)
- \*875
- 1147 Project Title : Mobile Food and Nutrition Extension Service.
- Organisation : Government of India; Ministry of Agriculture and Irrigation; Krishi Bhavan, New Delhi 110 001.
- Project Category : Applied.
- Cost : Rs. 25,00,000/-
- Duration : 1963-
- Sponsor(s) : Food and Nutrition Board.
- Investigator(s) : -
- \*876
- 1148 Project Title : Tamil Nadu . Nutrition Project for integrated food and nutrition development.
- Organisation : Government of India, Ministry of Agriculture and Irrigation; Krishi Bhavan, New Delhi 110 001; Tamil Nadu Nutrition Project, 7-A, Gopalpuram, First Street, Madras.
- Project Category : Fundamental and Applied.
- Cost : Rs. 10,00,000/-
- Duration : 1973-1979.
- Sponsor(s) : Food and Nutrition Board.
- Investigator(s) : Rajagopalan, S.; Panicker, K.S.K.
- \*873

#### Nutritional Disease

- 1149 Project Title : Stimulating rural women towards better utilisation of locally available foods for combating malnutrition.
- Organisation : Andhra Pradesh Agricultural University; College of Home Science Saifabad, Hyderabad 500 004.
- Project Category : Applied and Survey.
- Cost : Rs. 8,00,000/-.
- Duration : June 1977 - June 1980.



Sponsor(s) : International Development Research Centre, Canada.  
 Investigator(s) : Pushpamma, P.; Chiltemma Rao, K.  
 \*881

1150 Project Title : Studies on nutritional deficiencies with special reference to vitamin A and protein.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Biochemistry and Applied Nutrition Discipline.  
 Project Category : Fundamental and applied.  
 Cost : Rs. 4,55,500/-.  
 Duration : April 1979 - March 1982.  
 Sponsor(s) : Institute.  
 Investigator(s) : Rama Rao, P.B. and others.  
 Description : Vitamin A deficiency altered the erythrocyte membrane protein profile and caused the disappearance of taste buds in rats. In contrast, these changes were not noticed in membrane preparation from rats fed low protein but supplemented with retinoic acid. Decrease in electrophoresis mobility of erythrocytes and significant reduction in one of the glycoprotein of the erythrocyte membrane was observed. The reduction in adenosine deaminase activity of kidney and lung tissue in vitamin A deficient rats was confirmed. A significant reduction in alkaline phosphatase activity of villous cells and of esterase activity in 'crypt villous' fraction of fractionated intestinal cells was also noted. There was an increase in adenosine kinase activity of the lungs in vitamin A deficient rats. It was also observed that in vitamin A deficiency, the L-alanine (ALA) and L-aspartate (ASA)-2-oxoglutarate aminotransferase activities in serum were enhanced while ALA activities in all liver fractions and ASA in liver supernatant only were decreased. The liver alkaline phosphatase and serum acid phosphatase activities were enhanced.

Report(s) : -  
 Papers Published : -

1151 Project Title : A comparative biochemical and nutritional study on malnutrition and child mortality in urban and tribal areas.  
 Organisation : All India Institute of Hygiene and Public Health, Department of Biochemistry and Nutrition, 110, C.R. Avenue, Calcutta.  
 Project Category : Applied research.  
 Cost : Rs. 1,39,200/-.  
 Duration : Three years.  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Dr. Indira Chakravarty.  
 Description : To assess the nutritional status of the tribes of Lodha, Munda, Mahali and Kora in the District of Midnapur, West Bengal, to obtain their dietary pattern and health status.  
 Report(s) : Reports are sent to ICAR biannually for assessment.  
 Papers Published : 1. Chakravarty, Indira and others.  
 Nutritional Status of the Lodhas: A preliminary survey in a microsetting, Workshop on Birhor, AIIHPH, Calcutta.  
 2. Chakravarty, Indira and others.  
 A preliminary survey to evaluate the nutritional status of the Lodhas of Daharpur and Tal Birkar, Workshop on Birhor, July 23, AIIHPH, Calcutta 1984.  
 3. Chakravarty, Indira and Bagchi, T. Nutrition profile of the lodhas: a preliminary survey in a microsetting. Ind. Sci. Cong., Jan. 3-8, Lucknow, 1985.

1152 Project Title : Alterations in the metabolism and hormone levels under varied nutritional status in growing children.  
 Organisation : All India Institute of Hygiene and Public Health, Department of Biochemistry and Nutrition. Calcutta 700 073.  
 Project Category : Applied Research.  
 Cost : Rs. 2,19,600/-.  
 Duration : Three years.  
 Sponsor(s) : Indian Council of Medical Research.  
 Investigator(s) : Dr. Indira Chakravarty  
 Description : A cross-sectional study to determine the effect of mild, moderate and severe conditions of protein energy malnutrition on physical growth, sexual maturation and endocrinological profile (viz. LH, FSH, Prl, T3, T4, TSH, GH, Cortisol) of urban and rural children (0-18 years) of both sexes.  
 Report(s) : Reports have been sent annually to ICMR for evaluation.  
 Papers Published : 5 papers.

1153 Project Title : Inter-relationship of pesticide toxicity with dietary variation.  
 Organisation : All India Institute of Hygiene and Public Health, Department of Biochemistry and Nutrition, Calcutta.  
 Project Category : Basic Research.  
 Cost : Rs. 3,63,200/-.  
 Duration : Three years.  
 Sponsor(s) : Indian Council of Medical Research.  
 Investigator(s) : Dr. Indira Chakravarty.  
 Description : The correlation between dietary protein calorie malnutrition and pesticide toxicity is being evaluated to signify whether one of these conditions aggravate the other in any way or not.  
 Report(s) : Reports are sent to ICMR annually for evaluation.  
 Papers Published : 60 papers published.

### Toxicology

1154 Project Title : Toxicity studies on dyes and dye intermediates.  
 Organisation : Industrial Toxicology Research Centre, Mahatma Gandhi Marg, Lucknow 226 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : Since 1965 - continuing.  
 Sponsor(s) : Council of Scientific and Industrial Research.  
 Investigator(s) : Singh, G.B. and others.  
 Description : The project concentrates on conducting toxicity studies on dyes and dye-intermediates; conducting surveys of health hazard of textile workers, studying the problem of food adulteration due to colour additives; study of metabolic disposition pattern of food dyes; and development of new natural food grade pigments.  
 Report(s) : -  
 Papers Published : -

1155 Project Title : Evaluation of Lac dye as a possible food colouring agent.  
 Organisation : All India Institute of Hygiene and Public Health, Dept. of Biochemistry and Nutrition, Calcutta.  
 Project category : Basic Research.  
 Cost : Rs. 4,00,000/-.  
 Duration : Three years  
 Sponsor(s) : Shellac export promotion council, Ministry of Commerce)  
 Investigator(s) : Dr. Indira Chakravarty  
 Description : Lac dye a red coloured, water soluble nature dye obtained during the purification process of shellac is being widely speculated



- as a future food colouring agent. To evaluate the toxicity of lac dye detailed biochemical and histopathological studies were carried out in experimental rats at various doses and different time periods including multigeneration as well as carcinogenic and mutagenic studies.
- Report(s) : Reports were sent to SEPC annually.  
Papers Published : 60 papers.
- 1156 Project Title : Toxicological studies on plastics and chemical additives used in plastic industry.  
Organisation : Industrial Toxicology Research Centre, Mahatma Gandhi Marg, Lucknow 226 001.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Council of Scientific and Industrial Research.  
Investigator(s) : Seth, P.K. and others.  
Description : The toxic effects of plastics and chemical additives used in processing of plastics are being evaluated. Measures to prevent health hazards in plastic industry, and steps to ensure safety of plastic films used in packaging and storage of food, drugs and cosmetics are being developed. Studies on microbial biodegradation of plastics have also been undertaken.  
Report(s) : -  
Papers Published : -
- 1157 Project Title : Studies on the factors affecting synthesis and inhibition of aflatoxins.  
Organisation : Bhagalpur University, Bhagalpur 812 007; Post-graduate Department of Botany.  
Project Category : Exploratory.  
Cost : Rs. 51,200/-.  
Duration : 1980-1982.  
Sponsor(s) : Council of Scientific and Industrial Research.  
Investigator(s) : Bilgrami, K.S. and others.  
Description : The various factors regulating the synthesis of aflatoxins are investigated and suitable means of hampering the synthesis by the use of chemicals, pesticides and antibiotics are suggested.  
Report(s) : -  
Papers Published : 1. TCA intermediates in the production of aflatoxin and growth of Aspergillus parasiticus (NRRL-3240). Presented at 4th All India Botanical Conference at Calicut on December 28-30, 1981.  
2. Efficacies of underground plant part extracts against growth and aflatoxin production by Aspergillus parasiticus (NRRL-3240). Presented at 4th All India Botanical Conference at Calicut on December 28-30, 1981.
- 1158 Project Title : Interaction of aflatoxin B<sub>1</sub> with nucleic acids especially tRNA.  
Organisation : Bhabha Atomic Research Centre, Bombay.  
Project Category : Applied.  
Cost : -  
Duration : -  
Sponsor(s) : Centre  
Investigator(s) : Aboobaker, V.S.; Bhattacharya, R.K.  
Description : Interactions of aflatoxin B<sub>1</sub> with tRNA from rat liver and E.coli K12 have been studied using difference spectroscopy. The results prove that aflatoxin B<sub>1</sub> can interact with tRNA due to strong affinity for tRNA structure. The potential binding sites as obtained from Scatchard plots are 0.65 (rat liver) and 0.60 (E. coli)/100

nucleotides. It appears that guanine is mostly responsible for the binding of aflatoxin B<sub>1</sub>.

- Report(s) : -  
Papers Published : -
- 1159 Project Title : Studies on metallothioneins.  
Organisation : Institute of Science, 15, Madame Cama Road, Bombay 400 032;  
Biochemistry Department.  
Project Category : Fundamental.  
Cost : -  
Duration : September 1976 -  
Sponsor(s) : Institute.  
Investigator(s) : Inamdar, A.N.; Abdul Wajid, A.W.  
\*892
- 1160 Project Title : Toxicity of irradiated sugar solutions to microorganisms.  
Organisation :  
Project Category : Applied  
Cost : -  
Duration : -  
Sponsor(s) : Centre  
Investigator(s) : Subba Rao, V.; Aiyar, A.S.  
Description : Irradiated sugar solution inhibited growth of *Salmonella typhimurium*. In understanding the biochemical basis of this toxicity it was found that labelling of DNA and protein by radioactive precursor was inhibited in the presence of irradiated sugar solution. This effect was more marked in aerobically growing cells than in anaerobically growing cells. The nature of the mutagenic effect was assessed and it was found that the irradiated sugar solution induces both frame shift and missence type mutations. Irradiated ribose solution showed greater efficacy as a frame shift mutagen.  
Report(s) : -  
Papers Published : -
- 1161 Project Title : Influence of  $\alpha$ - and  $\gamma$ -isomers of hexachlorocyclohexane (HCCH) on successive generations and ageing in albino rats.  
Organisation : Central Food Technological Research Institute, Mysore 570013;  
Biochemistry and Applied Nutrition Discipline.  
Project Category : Fundamental.  
Cost : Rs. 1,37,000/-.  
Duration : April 1981 - March 1983  
Sponsor(s) : Institute.  
Investigator(s) : Srinivasa, K. and others.  
Description : Feeding  $\alpha$  and  $\gamma$  isomers of HCH at 800 ppm level for 2 weeks produced no ill effects on the menstrual cycle and on ovary in adult female rats. However several histological changes were seen in the testes of male rats. Wheat bran at 10% level in the diet along with 300 ppm of HCCH isomers showed a protective effect. Feeding 100 ppm of decamethrin for 45 days showed no pathological changes in rats.  
Report(s) : Consolidated report.  
Papers Published : Srinivasan, K. and Radhakrishna Murthy, R. Induction of MFOS by beta and gamma isomers of hexachlorocyclohexane (HCCH) in rats. (Presented at Annual Meeting of Biological Chemists (India), Baroda, November 1981).



## 11. CATERING TECHNOLOGY

- 1162 Project Title : Development of hotel management and catering technology.  
 Organisation : Government of India; Ministry of Agriculture and Irrigation; Krishi Bhavan, New Delhi 110 001; Department of Food; Food and Nutrition Board.  
 Project Category : Applied.  
 Cost : Rs. 15,35,000/- per 10 years  
 Duration : 1962-  
 Sponsor(s) : Government of India; and State Governments.  
 Investigator(s) : Kymal, P.K. and others.  
 \*904

## 12. INDUSTRIAL ECONOMICS

- 1163 Project Title : Trends in inequalities in consumption expenditure of rural and urban populations.  
 Organisation : University of Agricultural Sciences; G.K.V.K. Campus, Bangalore 560 055; Agricultural Economics Department.  
 Project Category : -  
 Cost : Rs.1,60,000/-.  
 Duration : 1978  
 Sponsor(s) : University.  
 Investigator(s) : Ranganatha Sastry, K.N.  
 \*907
- 1164 Project Title : Economics of cold storage plants in Bangalore.  
 Organisation : University of Agricultural Sciences; G.K.V.K. Campus, Bangalore 560 065; Agricultural Economics Department.  
 Project Category : -  
 Cost : Rs. 1,60,000/-.  
 Duration : 1978-  
 Sponsor(s) : University.  
 Investigator(s) : Shankar Murthy, H.G.  
 \*911
- 1165 Project Title : Seasonal changes in the cost of balanced diets.  
 Organisation : National Institute of Nutrition, Tarnaka, Hyderabad 500 007.  
 Project Category : Survey.  
 Cost : -  
 Duration : -  
 Sponsor(s) : ICMR  
 Investigator(s) : -  
 Description : The study was started in October 1976 and concluded in 1980 and covered retail prices of all commodities used as food. The cost of balanced diets was also calculated. Data indicate that it is possible to bring down the cost of diet without reducing nutrient  
 Report(s) : intakes.  
 Papers Published : -

Dairy Industry

- 1166 Project Title : To study the effectiveness of milk and milk products training programme in the villages of Karnal.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1976-  
 Sponsor(s) : Institute.  
 Investigator(s) : Kherde, R.L. and others.  
 \*922

- 1167 Project Title : Energy inputs in milk production in rural households.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost :  
 Duration : 1977-1979  
 Sponsor(s) : Institute.  
 Investigator(s) : Patel, R.K. and others.  
 \*935
- 1168 Project Title : Cost of milk production for various breeds of cattle maintained at NDRI, Karnal.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied and Survey.  
 Cost : -  
 Duration : 1969  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Kuber Ram and others.  
 Description : The project is concerned with the study of the milk production at NDRI for different breeds in and in different seasons, for different levels of milk production.  
 Report(s) : -  
 Papers Published : -  
 \*937
- 1169 Project Title : Sugam dairy project.  
 Organisation : National Dairy Development Board, Anand 388 001.  
 Project Category : -  
 Cost : -  
 Duration : 1981  
 Sponsor(s) : Board; Indian Dairy Corporation.  
 Investigator(s) : -  
 Description : The Sugam dairy was commissioned in January 1981 in the premises of Baroda Dairy to demonstrate the profitability of broadening the product line in modern dairies in response to local demands. It manufactures Chaisathi (a milk product), Shrikand and a low-cost extended 'tea enricher' under a common name 'Sugam'. It has also been equipped to manufacture other indigenous products like gulab jamun and peda. The process parameters for gulab jamun have been identified based on which the mechanical process of preparation is being improved. Shelf-life studied on gulab jamun produced on pilot scale are in progress to evaluate the relative suitability of polystyrene, plastic and glass containers.  
 Report(s) : -  
 Papers Published : -
- 1170 Project Title : Consumer opinion on milk and milk products in Punjab.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Survey.  
 Cost : -  
 Duration : 1980-1981.  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Rajvir Singh; Kalra, K.K.  
 Description : The opinion of consumers and non-consumers on the quality, packing and distribution of milk and milk products are collected and the awareness of the consumers on the availability of milk and milk products from different marketing agencies and their preferences for a specific product are analysed.  
 Report(s) : -  
 Papers Published : -



- 1171 Project Title : Impact of processing costs on investment productivity of public sector milk plants in Haryana.  
 Organisation : National Dairy Research Institute, Karnal 132 001; Dairy Economics Statistics and Management Division.  
 Project Category : Survey  
 Cost : -  
 Duration : 1980-1982  
 Sponsor(s) : ICAR  
 Investigator(s) : Charta Ram; Kalla, J.C.  
 Description : Data was collected from the dairy plants from the year of establishment to 1978-79 on various products manufactured, input costs, investment and sales expenditures and analysed by tabulation. The final tables would enable cost analysis of different stages of production and processing, estimation of direct and indirect benefits of investments and productivity estimation of investment on milk plants in plants and factories under the Haryana Dairy development Cooperative Federation.  
 Report(s) : Annual.  
 Papers Published : -
- 1172 Project Title : Consumption pattern of milk and milk products in Haryana State. An econometric study.  
 Organisation : National Dairy Research Institute, Karnal 132 001; Dairy Economic, Statistics and Management Division.  
 Project Category : Survey  
 Cost : -  
 Duration : 1980-82  
 Sponsor(s) : ICAR  
 Investigator(s) : Jain, D.K.; Patel, R.K.  
 Description : Data was collected from the 32nd round of National Sample Survey study on consumer expenditure following the stratified two stage sampling. The sample consisted about 6000 household spread over 360 villages and 144 urban blocks. The data on consumer expenditure, household characteristics and socioeconomic status of individual in the house holds were collected from 'consumer expenditure' and 'employment - unemployment' schedules. The data is being scrutinised and tabulated for computer analysis.  
 Report(s) : Annual  
 Papers Published : -
- 1173 Project Title : Economic analysis of rural milk processing in Rajasthan.  
 Organisation : National Dairy Research Institute, Karnal 132001.  
 Project Category : Survey.  
 Cost : -  
 Duration : 1980-1981.  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Arora, V.K. and others.  
 Description : The project aims to study the availability of milk in the milk shed area and the input, production pattern and practices involved in rural milk processing with particular reference to milk products like khoa, channa, ghee and dahi. The processing costs of major products with spatial, economic and social factors have been studied and the costs and returns of major milk products under different resource situations have been analysed.  
 Report(s) : -  
 Papers Published : -
- 1174 Project Title : Economics of optimal product scheduling in a milk product factory in Andhra Pradesh.  
 Organisation : National Dairy Research Institute, Karnal 132001; Dairy Economics; Statistics and Management Division.

- Project Category : Survey.  
 Cost : -  
 Duration : 1980-1981  
 Sponsor(s) : ICAR  
 Investigator(s) : Kalla, Jagdeesh C and others  
 Description : Data in a Vijayawada plant were collected by observation and discussion. The data were punched and processed at IARI to obtain solutions for pragmatic profit maximising product scheduling. The programmed solution are being scrutinised for their validity and application.  
 Report(s) : Annual.  
 Papers Published : -
- 1175 Project Title : Cost of processing of milk and cost of manufacturing different dairy products.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Survey.  
 Cost : -  
 Duration : 1969  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Rajvir Singh; Kalra, K.K.  
 Description : The project aims to estimate the cost components for processing of milk and manufacturing different dairy products.  
 Report(s) : -  
 Papers Published : Nil  
 \*946
- 1176 Project Title : Procurement of milk from member co-operative societies and marketing of processed milk and by products.  
 Organisation : Rajkot District Cooperative milk producers Union. Ltd., Dudhsagar Marg, Rajkot 360003.  
 Project Category : -  
 Cost : Rs. 1.5 crores  
 Duration : 1972 continuing  
 Sponsor(s) : Government of Gujarat and District Cooperative Bank, Rajkot.  
 Investigator(s) : -  
 Description : Procurement, processing and marketing of milk and milk products are being carried out on a cooperative basis.  
 Report(s) : -  
 Papers Published : -
- 1177 Project Title : A study of socio-economic and psychological correlates in organisation and functioning of dairy cooperatives  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977-1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Banja, S.K.; Dubey, V.K.  
 \*953
- 1178 Project Title : A study of organisation and functioning of a Milk Producers' Cooperative Society in the ICDP area of Karnal.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Survey.  
 Cost : -  
 Duration : 1976 -  
 Sponsor(s) : Institute.  
 Investigator(s) : Dubey, V.K.; and others.  
 \*954



- 1179 Project Title : Economic analysis of farm machinery used at NDRI farm, Karnal.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Survey.  
 Cost : -  
 Duration : 1980-1982.  
 Sponsor(s) : Indian Council of Agricultural Research  
 Investigator(s) : Sharma, S.K. and others.  
 Description : Time and motion efficiency of different farm machinery, cost benefit ratio of different operation, and optimal machine-hour utilization for various operations are investigated.  
 Report(s) : -  
 Papers Published : -
- 1180 Project Title : An economic study of collection, transportation and chilling of milk in a public sector plant.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Survey.  
 Cost : -  
 Duration : 1977-1981  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Kuber Ram and others.  
 Description : The cost of collection, transportation and chilling of milk at various stages and the seasonal variation in the costs have been estimated. The investment pattern for various operations and the employment potential are also ascertained.  
 Report(s) : -  
 Papers Published : -
- 1181 Project Title : Economic analysis of processing and marketing of milk and milk products for a commercial plant.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Survey.  
 Cost : -  
 Duration : 1979-1981.  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Rajvir Singh, Kalra, K.K.  
 Description : The project ascertains the various direct and indirect costs and their relative shares in the total cost of processing milk and milk products; examines the present marketing and distribution system of the plant; and estimates the unit cost of products marketed.  
 Report(s) : -  
 Papers Published : -
- 1182 Project Title : Impact of handling losses of fat and SNF on the cost of processing of market milk, table butter and ghee.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Survey.  
 Cost : -  
 Duration : 1981-1982.  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Rawat, B.S. and others.  
 Description : The extent of losses incurred in processing is assessed and the unavoidable and avoidable losses are quantified. The cost factors of losses at different levels of capacity utilization are estimated and methodologies for such studies are formulated.  
 Report(s) : -  
 Papers Published : -

- 1183 Project Title : A study of marketing of milk and milk products in Bangalore city.  
 Organisation : National Dairy Research Institute; Southern Regional Station, Adugodi, Bangalore 560 030.  
 Project Category : Applied and Survey.  
 Cost : -  
 Duration : 1976-  
 Sponsor(s) : Institute.  
 Investigator(s) : Reddy, Y.V.R.; Sampath, S.R.  
 \*940
- 1184 Project Title : Studies on the contribution of dairy extension to milk production in Bangalore District.  
 Organisation : National Dairy Research Institute; Southern Regional Station, Adugodi, Bangalore 560 030.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1974-  
 Sponsor(s) : Institute.  
 Investigator(s) : Vijayalakshmi, S. and others.  
 \*930
- 1185 Project Title : Economics of milk production in Bombay Region: Sub-urban, Aarey Milk Colony and rural.  
 Organisation : National Dairy Research Institute; Western Regional Station, Aarey Milk Colony, Bombay 400 065.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1973-  
 Sponsor(s) : Institute.  
 Investigator(s) : Rawat, B.S.  
 \*931
- 1186 Project Title : Socio-economic survey for estimation of milk production and formulation of a strategy for milk enhancement programme in the milkshed areas of Hindustan Milk Food Manufacturers Ltd., Nabha, Punjab.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Applied.  
 Cost : -  
 Duration : 1977-1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Patel, R.K. and others.  
 \*932
- 1187 Project Title : A study of ghee marketing in Western regions of Uttar Pradesh.  
 Organisation : National Dairy Research Institute, Karnal 132 001.  
 Project Category : Survey.  
 Cost : -  
 Duration : 1979-1981  
 Sponsor(s) : Indian Council of Agricultural Research.  
 Investigator(s) : Solanki, R.S. and others.  
 Description : The project aims to ascertain the cost of marketing in different channels and the different marketing functions and their cost in the trade of ghee. The price spread and market margins at different levels are ascertained and the variation in the price of ghee and factors associated with it are studied.  
 Report(s) : -  
 Papers Published : -



## Fruit and Vegetable Industry

1188 Project Title : A study on the economics of production and marketing problems of vegetable producers in Bangalore District.  
 Organisation : University of Agricultural Sciences; G.K.V.K. Campus, Bangalore 560065; Agricultural Economics Department.  
 Project Category : Applied and Survey.  
 Cost : Rs. 1,60,000/-.  
 Duration : 1977/-  
 Sponsor(s) : University.  
 Investigator(s) : Mallikarjunaiah, K.G.  
 \*916

1189 Project Title : Study of marketing fresh fruit and vegetables of commercial importance in view to assess packaging, transportation hazards and marketing practices in Bombay whole-sale market.  
 Organisation : Central Food Technological Research Institute, Experiment Station, Bombay.  
 Project Category : Applied.  
 Cost : Rs. 45,000/-  
 Duration : April 1977 - March 1980  
 Sponsor(s) : Institute.  
 Investigator(s) : Shah, G.R.; Gosavi, A.N.  
 Description : Selected fruits were studied in respect of arrival seasons to Bombay markets producing-cum-despatching centres, packaging and transportation. The objective is to evaluate the methods adopted, and advise better methods.  
 Report(s) : Final.  
 Papers Published : -  
 \*915

## Meat and Fish Industry

1190 Project Title : Marketing models for meat, fish and poultry.  
 Organisation : Central Food Technological Research Institute, Mysore, 570013; Meat, Fish and Poultry Technology Discipline.  
 Project Category : Developmental.  
 Cost : Rs. 47,600/-.  
 Duration : April 1978-April 1979.  
 Sponsor(s) : Institute.  
 Investigator(s) : Moorjani, M.N. and others.  
 Description : Prototype stalls for retail marketing were designed and fabricated with a view to facilitate hygienic handling practices.  
 Report(s) : Final.  
 Papers Published : -  
 \*955

1191 Project Title : Cost evaluation and test marketing of thermal processed fish products.  
 Organisation : Central Food Technological Research Institute, Mysore 570013; Meat, Fish and Poultry Technology Discipline.  
 Project Category : Applied.  
 Cost : Rs. 35,299/-  
 Duration : September 1978 - May 1980.  
 Sponsor(s) : Institute.  
 Investigator(s) : Nair, R.B.; Chatterji, A.K.  
 Description : Earlier various thermally processed products developed in the laboratory from unconventional fish were evaluated for cost and test marketed among urban consumers. The studies were

continued with two products (frozen curry and breaded fish) and involved collection of process data on yield, raw material cost, energy, labour and service inputs; process control with respect to hygiene packaging; sale of the product; and consumer reaction through a questionnaire. The results showed frozen fish curry was highly acceptable.

Report(s) : Final.

Papers Published : -

\*957



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